6/96

SPECIAL EQUIPMENT COMMERCIAL SERVICE MANUAL

MANUAL NO. 9-057-182-00
REV. NO. A

LAB-LINE® FLO-THRU® CO2 INCUBATORS

MODEL NOs | 325GVT
325-1GVT

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SECTION 1

INTRODUCTION

THANK YOU

for selecting Lab-Line Instruments for your equipment needs. For maximum value and ease of start-up,

PLEASE PROCEED AS FOLLOWS:

- Inspect the carton and contents for shipping damage. Notify the carrier immediately if damage is found.
- Use the Accessory Checklist when unpacking to verify that the complete unit has been received. Do not discard packing materials until all is accounted for.
- Read this Operation Manual thoroughly *before* deciding upon an appropriate location for the unit: you will want to consider the availability of power, water, hook-ups, drains and other unit requirements, as well as user convenience.
- Insist that every operator of this unit becomes familiar with the Operation Section of this manual.
- Be sure to fill out the Warranty Registration Card and mail it in to Lab-Line Instruments within seven (7) days after receiving the unit.

IF

after reading this manual you should have any difficulties with the installation or operation instructions, please call:

Lab-Line Customer Relations Department
708/450-2600 (in Illinois)
1-800/LAB-LINE (elsewhere)

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SECTION 2

GENERAL INFORMATION

The CO_2 Incubators covered by this manual provide for the control of CO_2 concentration and temperature to create a growth environment for tissue cultures, plants, cells, viruses and related organisms. The incoming gas mixture passes through the rear plenum and is gently circulated throughout the chamber.

Separate flowmeters are adjustable for air and CO_2 rates and an access port on the control panel permits chamber gas samples to be taken.

Two hydraulic thermostats—one for setpoint control and the other as an overtemperature limit— regulate temperature. If the control thermostat should fail, the overtemperature-limit thermostat will protect chamber contents.

Strip-heaters on the outside of the chamber inner walls are positioned for uniform heat distribution, while high density fiberglass insulation minimizes heat loss. A fan in the chamber ceiling circulates chamber atmosphere to prevent temperature and CO_2 stratification.

The double door system has a tempered glass inner door which provides unobstructed viewing of the entire chamber. In the steel outer door are heaters which can be turned on to defog the glass inner door if necessary. Heat control for the steel outer door is on the back panel.

The leakproof chamber is constructed of heavy-gauge stainless steel and the steel cabinet has a baked enamel finish for easy cleaning. Stainless steel shelves are adjustable and removable.

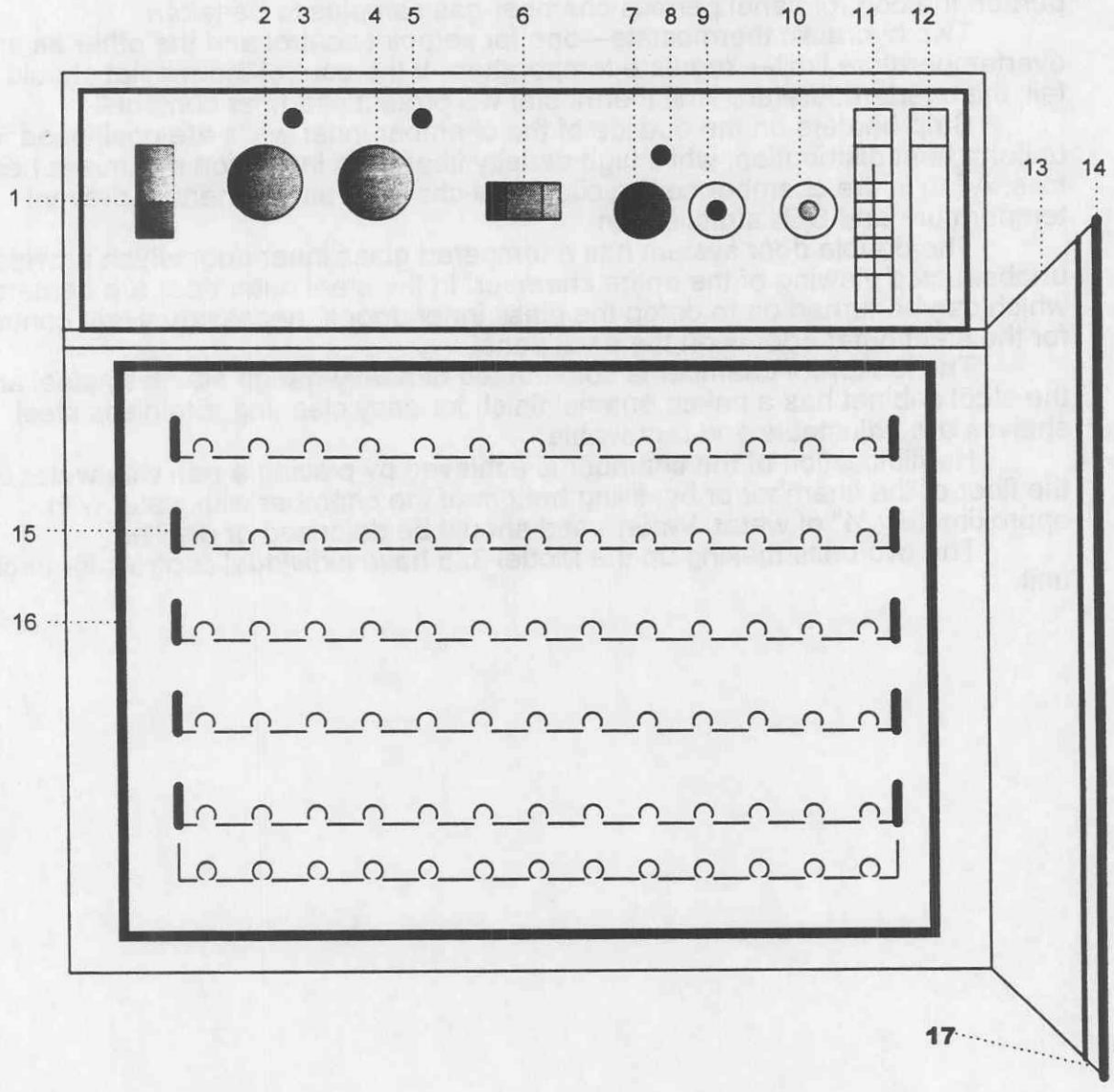
Humidification of the chamber is achieved by placing a pan with water on the floor of the chamber or by, filling bottom of the chamber with water with approximately ½" of water. Water used should be deionzed or distilled.

The two units making up the Model 325 have individual controls for each unit.

GENERAL INFORMATION: (Con't)

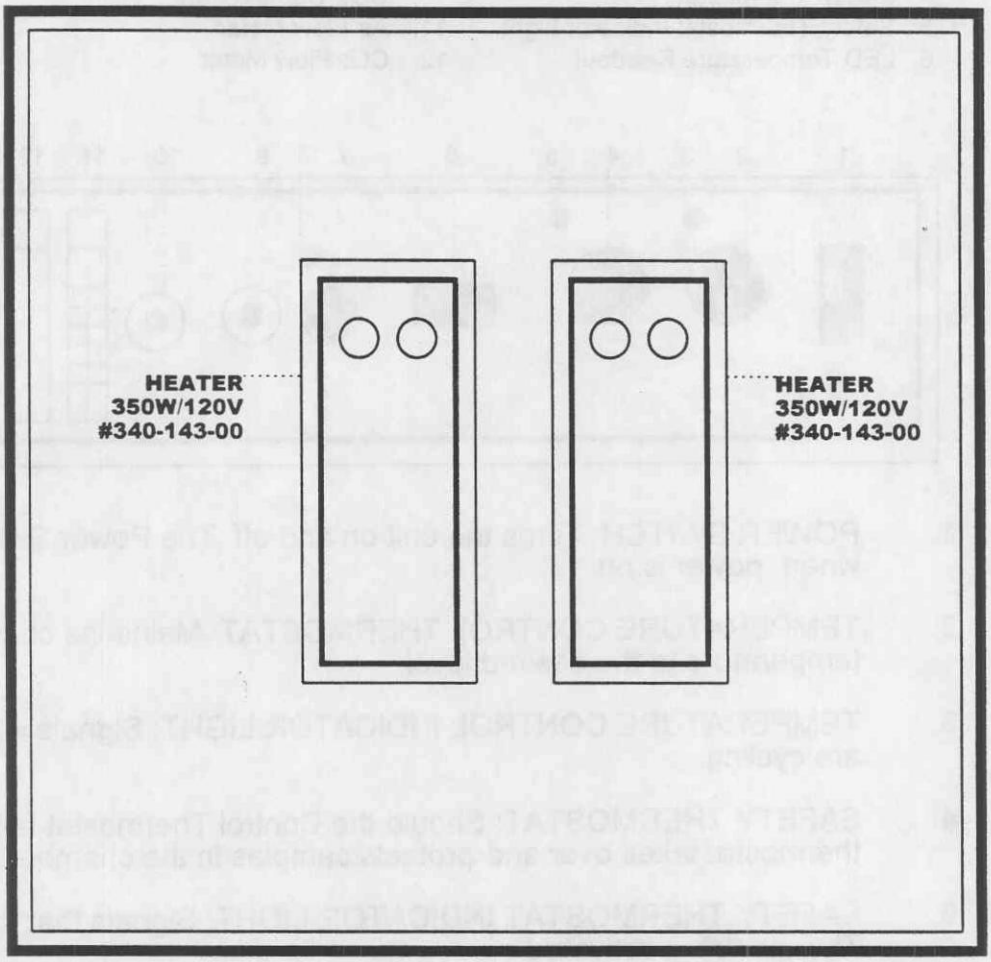
Figure 1: OVERALL UNIT/CONTROLS

ITEM:	PART NO.	ITEM:	PART NO.
1. Power Switch ("On-Off' Switch)	440-359-00	9. CO_2 Kwik-Inject pushbotton switch	440-080-00
2. Temperature Control Thermostat	920-301-00	10. CO_2 Sample Port	660-100-00
3. Temperature Control Indicator Light	360-235-01	11. Air Flow Meter	660-101-00
4. Safety Thermostat	920-301-00	12. CO_2 Flow Meter	660-043-00
5. Safety Thermostat Indicator Light	360-234-01	13. Clear-Vue Inner Door	014-940-00
6. LED Temperature °C Readout	228-088-00	14. Steel Outer Door	017-330-00
7. CO_2 Kwik-Inject Timer	485-180-00	15. Shelves	593-108-00
8 . CO_2 Kwik-Inject Indicator Light	360-238-00	16. Door Gasket (Inner Door)	530-192-00
		17. Door Gasket (Outer Door)	530-189-00



GENERAL INFORMATION: (Con't)

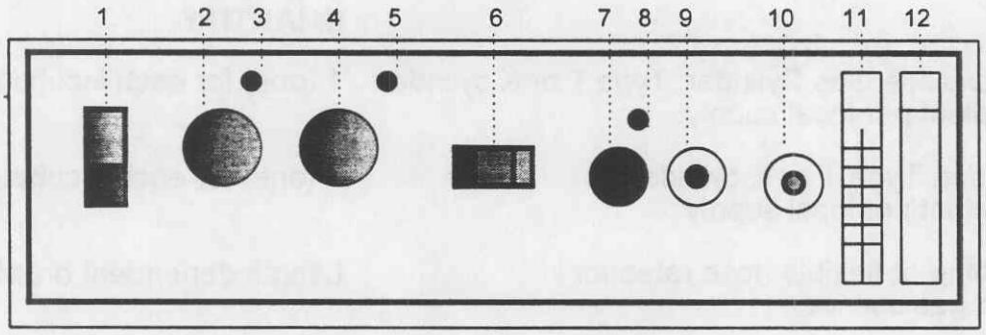
Figure 2: POSITION OF HEATERS, BACK OF UNIT



GENERAL INFORMATION: (Con't)

Figure 3: CONTROL PANEL DETAIL

1. Power Switch ("On-Off" Switch)
2. Temperature Control Thermostat
3. Temperature Control Indicator Light
4. Safety Thermostat
5. Safety Thermostat Indicator Light
6. LED Temperature Readout
7. CO_2 Kwik-Inject Timer
8. CO_2 Kwik-Inject Indicator Light
9. CO_2 Kwik-Inject pushbutton switch
10. CO_2 Sample Port
11. Air Flow Meter
12. CO_2 Flow Meter



9. CO_2 KWIK-INJECT PUSHBUTTON SWITCH: Activates the timer.

10. CO_2 SAMPLE PORT: The means by which CO_2 is sampled from the chamber without compromising chamber integrity.

11. AIR FLOW METER: Used in conjunction with the CO_2 Flow Meter, and the proper flow rates, it maintains the desired CO_2 level in the chamber.

12. CO2 FLOW METER: Used in conjunction with the Air Flow Meter, and the proper flow rates, it maintains the desired CO_2 level in the chamber.

GENERAL INFORMATION: (Con't)

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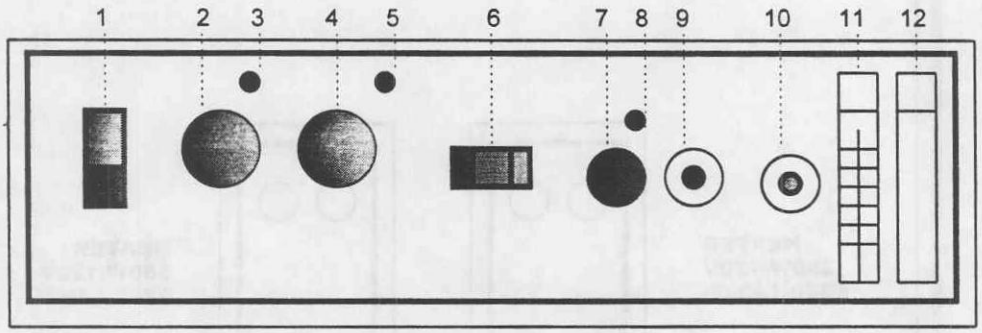


1. POWER SWITCH: Turns the unit on and off. The Power Switch will be lit when power is on.

2. TEMPERATURE CONTROL THERMOSTAT: Maintains chamber temperature to the desired level.

3. TEMPERATURE CONTROL INDICATOR LIGHT: Signals when heaters are cycling.

4. SAFETY THERMOSTAT: Should the Control Thermostat fail, this thermostat takes over and protects samples in the chamber.

5. SAFETY THERMOSTAT INDICATOR LIGHT: Signals that the Safety Thermostat is activated.

6. LED TEMPERATURE READOUT: Displays actual chamber temperature in degrees Celsius (°C).

7. CO_2 KWIK-INJECT TIMER: Limits injection time.

8. CO_2 KWIK-INJECT INDICATOR LIGHT: Signals the solenoid is open and injecting gas into the system.

GENERAL INFORMATION: (Con't)

EQUIPMENT AND ACCESSORIES SUPPLIED:

ITEM	PART NUMBER	QUANTITY
Shelves	593-108-00	12

EQUIPMENT REQUIRED, BUT NOT SUPPLIED:

ITEM	QUANTITY
Carbon Dioxide Gas Cylinder: Type T or K cylinder or equivalent per local supply.	1 (one) for each incubator.
Air Cylinder: Type T or K cylinder or equivalent per local supply.	1 (one) for each incubator.
¼" ID tubing or flexible hose rated for indicated gas service.	Length dependent on site of use.
2-stage gas regulator.	1 (one) for each of the cylinders—or a total of 4.
Stainless steel pan to hold water for humidification purposes. Approximate measurement: 20" W x 20" D x 2" H.	1 (one) pan for each incubator.

GENERAL INFORMATION: (Con't)

SPECIFICATIONS:

TEMPERATURE:	Range: From slightly above ambient to 60°C. Control: ± 0.5°C. Uniformity: ± 0.2°C
HUMIDITY RANGE:	From ambient to 98% relative humidity.
CARBON DIOXIDE RANGE:	From 0 to 20% of the mixture.
ELECTRICAL REQUIREMENTS:	325: 120 VAC, 50/60 Hz, 6.7 Amps per unit (13.4 Amps total), 1600 Watts 325-1: 240 VAC, 50/60 Hz, 3.4 Amps per unit (6.8 Amps total), 1600 Watts
WEIGHT (NET), DUAL VERTICAL UNITS:	365 Pounds (166 kg)

DIMENSIONS:

Model	No. of Chambers	Overall	Single Chamber
325, 325-1	Dual, Vertical Units individually controllable	24½"W x 24"D x 65"H (62 x 61 x 165 cm)	22"W x 22"D x 22"H (56 x 56 x 56 cm)

Model	Volume	Shelves*	Shelf Area
325, 325-1	21,296 cu. in. 351,232 cu. cm. 12.4 cu. ft.	12	33.4 sq. ft

*A maximum of 20 shelves in dual units can be used.

UNIT'S ENVIRONMENTAL OPERATING CONDITIONS:

POLLUTION DEGREE:	2
INSTALLATION CATEGORY:	II
ALTITUDE:	2000 Meters MSL (Mean Sea Level)
HUMIDITY:	80% maximum, non-condensing
ELECTRICAL SUPPLY:	120VAC or 240VAC
VOLTAGE TOLERANCE:	±10% of normal rated line
TEMPERATURE:	15°C to 40°C
PRODUCT USAGE:	This product is intended for use indoors **only**

GENERAL INFORMATION: (Con't)

INSTALLATION:

The Model 325 is shipped as two units. One unit has a stacking-rack on top and is used as the floor or base unit. The other unit is then placed on top of the base unit.

Due to the weight of the units (approximately 154 pounds each), two persons using proper lifting technique should be used to remove the units from the cartons and position one on top of the other.

In the event of a need for subsequent storage, the shipping cartons and packing materials should be saved for repacking the units.

LOCATION:

Place the unit where it will be used, away from external vibration sources, drafts and wide variations in ambient temperature. Choose a location near a power supply that matches the unit nameplate requirements.

CAUTION: THIS UNIT IS DESIGNED FOR USE WITH **GASEOUS AIR, CO_2 OR NITROGEN ONLY. DO NOT USE WITH ANY OTHER GASES**. FAILURE TO OBSERVE THESE PRECAUTIONS CAN RESULT IN EXPLOSION AND/OR FIRE AND SERIOUS INJURY AND/OR DEATH AND PROPERTY DAMAGE.

GAS HOOK-UP:

Rotate all flowmeters on the incubator fully clockwise (closed). Connect air and CO_2 supply lines to their respective fittings on the back of the unit. Use ¼" ID tubing, flexible metal hose (meeting local codes) with filters to insure that the air and CO_2 are free of contaminants, for gas lines. (Please refer to Figure 4, page GEN/INFO-9.)

Set the supply regulators at 10 psi. Check all of the connections for leaks using a sudsy solution of soap and water. Apply to the connections and observe if there is any breakthrough of bubbles that might result from a leaking gas. If any leaks are found, determine cause and make necessary repairs: these can include using sealing compounds, new gaskets or replacement of entire faulty part. If no leaks are found, proceed with the following steps.

NOTE: IN DUAL CHAMBER MODELS, EACH CHAMBER HAS A SEPARATE SET OF AIR AND GAS FITTINGS.

WARNING: HIGH CONCENTRATIONS OF CARBON DIOXIDE PRODUCE METABOLIC ABNORMALITIES, DISTURBANCES OF THE CENTRAL NERVOUS SYSTEM AND CARDIAC INSTABILITY—UNCONSCIOUSNESS MAY OCCUR AT CONCENTRATIONS ABOVE 10%.

GENERAL INFORMATION: (Con't)

INSTALLATION: (Con't)

HUMIDIFICATION:

To raise the humidity in a chamber to above ambient, add water by either placing a pan of water in the bottom of the chamber, or by adding water (maximum depth of ½") to the chamber floor. In either case, USE ONLY DISTILLED OR DEIONIZED WATER.

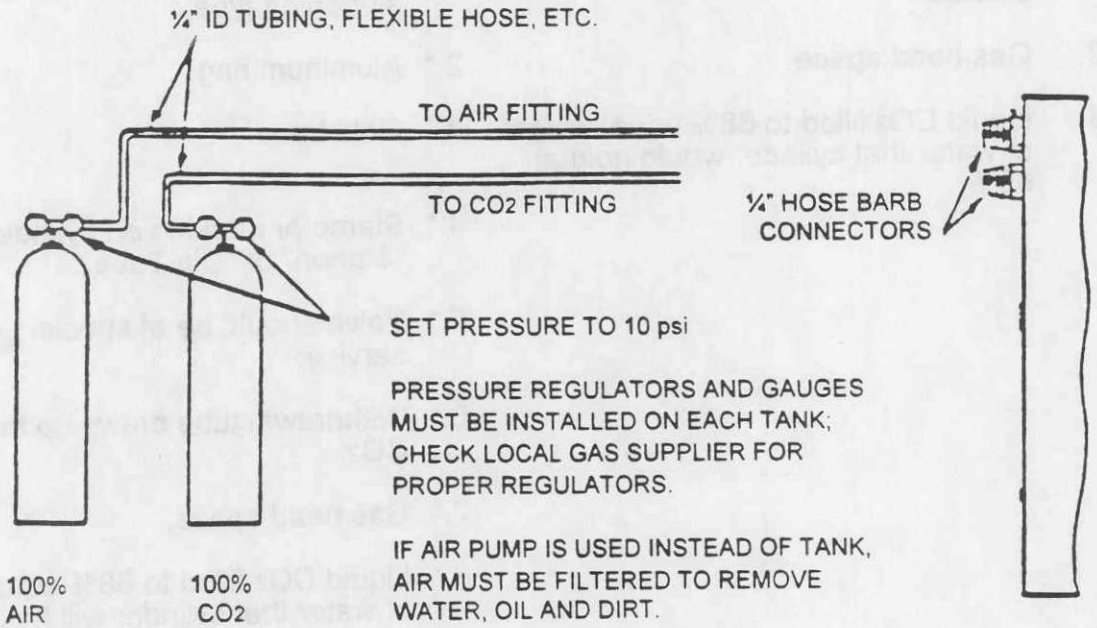
ELECTRICAL CONNECTION:

The unit is supplied with a 3-wire line cord. It should be plugged into an outlet designed for 3-prong plugs. For an outlet designed to accept 2-prong plugs (ungrounded), it is recommended that a qualified electrician replace it with a new grounded outlet.

If a plug must be installed, use only the 3-prong grounded type, rated for the unit load requirements and matching the power outlet. Make sure the green ground wire is secured to the plug ground terminal. (Please refer to the wiring diagram as necessary.)

Turn the Power Switch to **OFF** and insert the plug into the outlet.

Figure 4: AIR/CO_2 HOOK-UPS


¼" ID TUBING, FLEXIBLE HOSE, ETC.
TO AIR FITTING
TO CO2 FITTING
¼" HOSE BARB CONNECTORS
SET PRESSURE TO 10 psi
PRESSURE REGULATORS AND GAUGES MUST BE INSTALLED ON EACH TANK; CHECK LOCAL GAS SUPPLIER FOR PROPER REGULATORS.
IF AIR PUMP IS USED INSTEAD OF TANK, AIR MUST BE FILTERED TO REMOVE WATER, OIL AND DIRT.
100% AIR
100% CO2

GENERAL INFORMATION: (Con't)

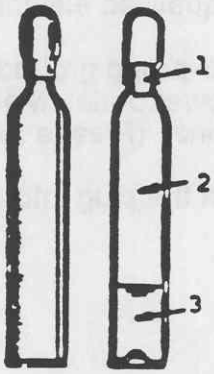
INSTALLATION: (Con't)

CO_2 CONNECTION:

Be sure to use lab-grade, dry carbon dioxide cylinders. **Do not use a CO_2 cylinder marked "Siphon" or "Dip Tube"; these are used expressly for making dry ice and are not suitable for use with this incubator. (See the comparison below.)**

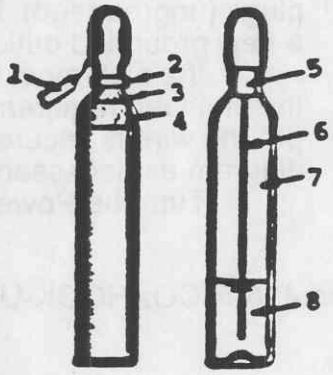
Figure 5: STANDARD AND SIPHON TYPE CO_2 GAS CYLINDERS

STANDARD



1. Valve should be of a special type for service.
2. Gas head space.
3. Liquid CO_2 filled to 68% equal weight of water that cylinder would hold at 60°F.

SIPHON TYPE



1. Warning tag indicating that cylinder is siphoning type.
2.* Aluminum ring.
3.* Gold band.
4.* Stamp or marking on cylinder: "Siphon" or "Dip Tube".
5.* Valve should be of special type for service.
6.* Withdrawal tube draws up the liquid CO_2.
7.* Gas head space.
8.* Liquid CO_2 filled to 68% equal weight of water that cylinder will hold at 60°F.

* SOME GAS SUPPLIERS WILL HAVE NO MARKINGS TO INDICATE A "DIP TUBE" OR "SIPHON" TYPE CYLINDER. **BE SURE TO ORDER DRY, LAB-GRADE CO_2.**

GENERAL INFORMATION: (Con't)

OPERATION:

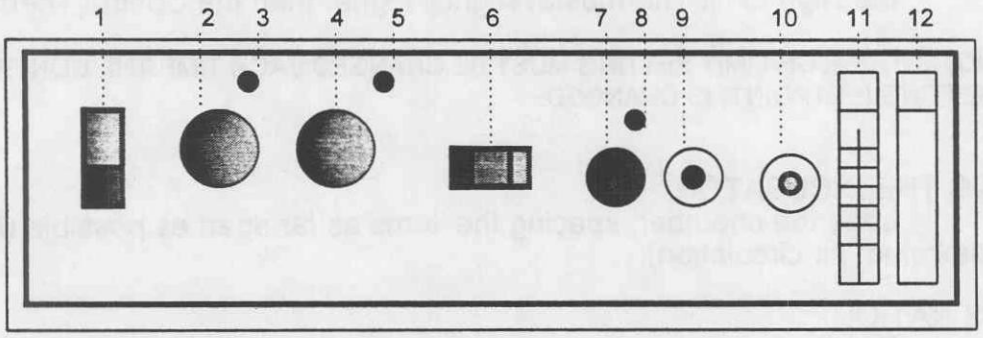
DANGER: DO NOT USE IN THE PRESENCE OF FLAMMABLE OR COMBUSTIBLE MATERIALS OR EXPLOSIVE GASES. DO NOT USE IN THE PRESENCE OF PRESSURIZED OR SEALED CONTAINERS. FIRE OR EXPLOSION MAY RESULT, CAUSING DEATH OR SEVERE INJURY.

WARNING: DO NOT HEAT ANY SUBSTANCE ABOVE A TEMPERATURE WHICH WILL CAUSE IT TO EMIT TOXIC FUMES. DEATH OR SEVERE INJURY MAY RESULT.

NOTICE: WE RECOMMEND THAT UNIT RUN 24 HOURS EMPTY BEFORE INTRODUCING MEDIA TO BE INCUBATED. THIS WILL FACILITATE EASE OF SERVICING, IF REQUIRED, AND NULLIFY THE NEED TO DECONTAMINATE CHAMBER IN THE EVENT OF A PROBLEM OCCURRING.

Figure 6: CONTROL PANEL

1. Power Switch ("On-Off" Switch)
2. Temperature Control Thermostat
3. Temperature Control Indicator Light
4. Safety Thermostat
5. Safety Thermostat Indicator Light
6. LED Temperature Readout
7. CO_2 Kwik-Inject Timer
8. CO_2 Kwik-Inject Indicator Light
9. CO_2 Kwik-Inject pushbutton switch
10. CO_2 Sample Port
11. Air Flow Meter
12. CO_2 Flow Meter



GENERAL INFORMATION: (Con't)

OPERATION:(Con't)

STARTING THE UNIT:

Push the Power Switch to **ON**. The Power Switch will be lit when power is **ON**. Dual chamber models have two separate Power Switches and Power Lamps. The chambers can be used independently or together.

SETTING THE TEMPERATURE CONTROL THERMOSTAT:

A. Rotate the High-Limit Thermostat fully clockwise; then rotate the Control Thermostat clockwise to approximate desired temperature (the setpoint).

B. Allow time for chamber temperature to stabilize before proceeding. The Control Lamp is lit when heaters are energized and not lit when heaters are not energized (between heating cycles). Allow several heating cycles to pass.

C. Check the LED temperature readout on control panel, then adjust the Control Thermostat closer to the desired setpoint—rotate the knob clockwise to raise the temperature, counterclockwise to lower it.

D. Repeat Steps B and C above as needed until setpoint is maintained.

SETTING THE HIGH LIMIT THERMOSTAT:

- When the Control Lamp is lit, rotate the High Limit Thermostat counterclockwise until the Control Lamp goes out and High Limit Lamp is lit.

- Turn the High Limit Thermostat back clockwise slowly, just until the Control Lamp is again lit. Then rotate it another 5 degrees clockwise to set the High Limit Thermostat slightly higher than the Control Thermostat.

NOTE: THE HIGH LIMIT SETTING MUST BE CHANGED EACH TIME THE CONTROL SETTING (SETPOINT) IS CHANGED.

LOADING THE INCUBATOR:

Load the chamber, spacing the items as far apart as possible (for maximum air circulation).

AIR/GAS RATIO:

Set the flowmeters to obtain the required air and CO_2 flow—using the lowest possible CO_2 flow rate will help to conserve gas.

GENERAL INFORMATION: (Con't)

OPERATION:(Con't)

Use one of the following formulas or the nomogram on next page (OP-4) of this manual to find the desired air-to-gas ratio:

R = % CO_2 in the chamber atmosphere
A = Air flow in liters/minute
C = CO_2 flow in liters/minute

Equation 1 (to be used if air and CO_2 flow rates are known):

$$R = \frac{C}{A + C} \times 100$$

Equation 2 (to be used if air flow rate and % CO_2 are known):

$$C = \frac{RA}{100 - R} \text{ liters/min.}$$

Equation 3 (to be used if CO_2 flow rate and % CO_2 are known):

$$A = \frac{100C - RC}{R} \text{ liters/min.}$$

EXAMPLE 1: If a CO_2 percentage of 15% is desired at a flow rate of 0.4 liters/min. of CO_2 use Equation 3:

$$A = \frac{100\,(0.4) - 15\,(0.4)}{15} = \frac{40 - 6}{15}$$

$$= 2.26 \text{ liters/min. of air}$$

EXAMPLE 2: If flow rates are set 0.1 liters/min. of CO_2 and 3 liters/min. of air, use Equation 1 to find percentage of CO_2:

$$R = \frac{0.1}{3.0 + 0.1} \times 100 = 3.2\% \; CO_2 \text{ in chamber atmosphere}$$

KWIK-INJECT SYSTEM:

The Kwik-Inject system permits bypassing the flowmeter to inject gas directly from the supply into the chamber. A timer on the control panel limits injection time—from 0 to 60 seconds. To determine the proper time, consult the equation below:

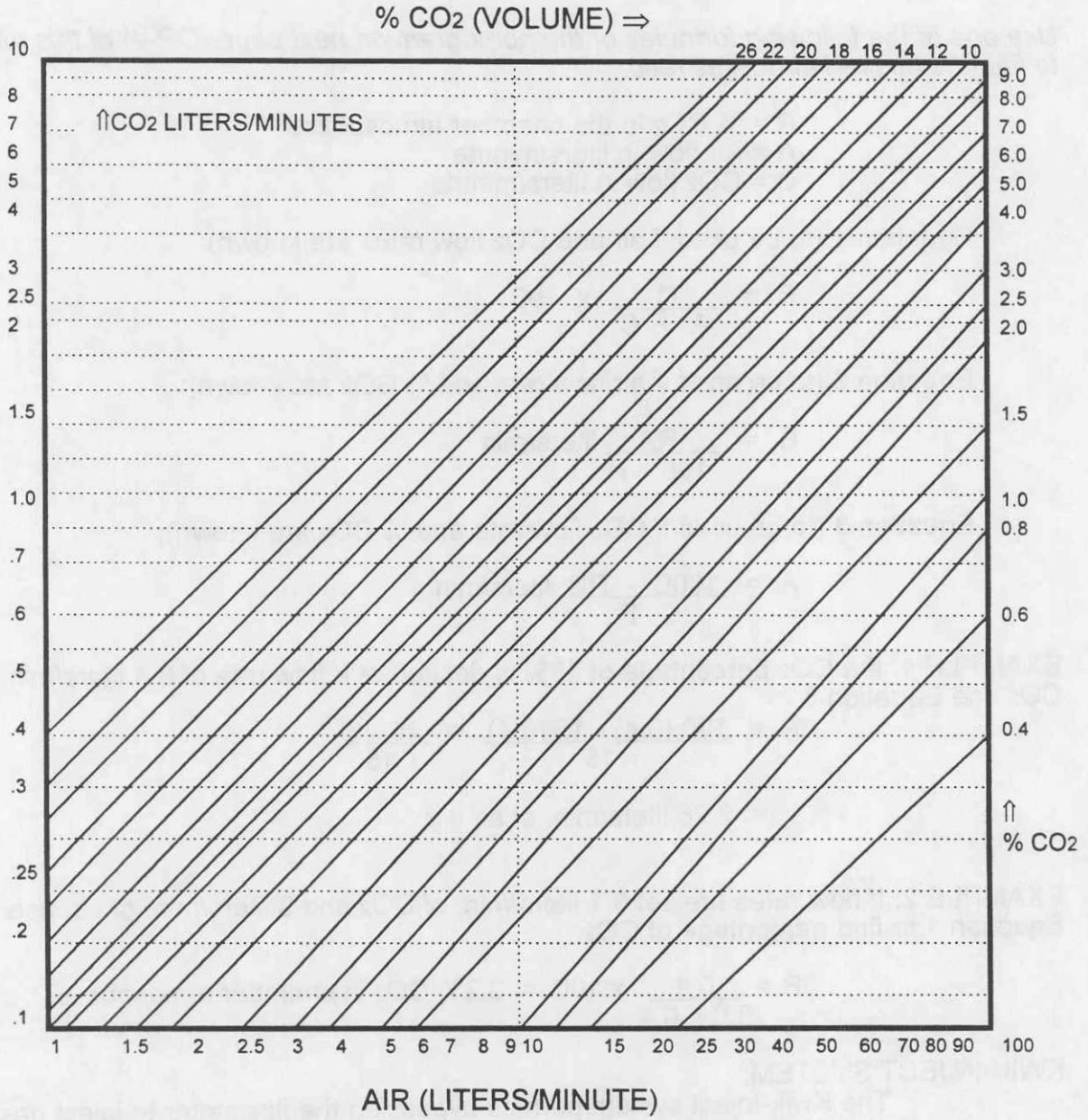
MODEL	TANK	PRESSURE TIME (T)
All models	10 psi	$T = 1.28 \times \%\ CO_2$

Set the timer to the calculated time and push the button to the right side of the timer when rapid CO_2 injection is desired.

GENERAL INFORMATION: (Con't)

OPERATION:(Con't)

Figure 7: AIR/CO-2 RATIO NOMOGRAM



NOTE: THIS CHART SHOWS THE CO2 FLOW RATE (LITERS/MINUTE) REQUIRED FOR A SPECIFIC AIR/CO2 RATIO. DRAW A VERTICAL LINE FROM THE POINT REPRESENTING THE AIR FLOW RATE ON THE HORIZONTAL AXIS UNTIL IT INTERSECTS WITH THE DESIRED CO2 FLOW RATE.

TO OBTAIN THE AIR FLOW RATE, WITH CO2 FLOW RATE (LITERS/MIN.) AND CO2 PERCENTAGE KNOWN, REVERSE THE ABOVE PROCEDURE.

GENERAL INFORMATION: (Con't)

OPERATION:(Con't)

HUMIDITY ADJUSTMENT:

Chamber humidity can be raised by placing pan with water on chamber floor, or by adding water (maximum depth of ½") to chamber floor. For minimum humidity chamber should be dry.

CO_2 SAMPLING/MEASUREMENT:

Insert sample probe into CO_2 Sample Port (Item No. 10 on Control Panel; see Figure 6 pageGEN/INFO-11) making sure that a tight seal is attained. Obtain a sample of CO_2 sufficiently large to meet the requirements of the analytical apparatus or procedure being used. Perform CO_2 analysis.

DOOR DEFOGGER

The door heat control on the back panel should be off except when fogging of the inner door occurs. If this happens close the outer door and turn on the heat control—rotate it counterclockwise to increase heat and clockwise to decrease heat. Wait a few minutes before opening door to see if fog dissipates. If not, turn control in increments of 1 to higher setting.

OPERATING SUGGESTIONS:

- In order to obtain and maintain the desired CO_2 gas pressure, periodically check the tightness and integrity of the gasket which secures the glass door to the chamber.
- To be sure of maintaining desired gas pressure, periodically check outflow pressure from gas supply source.
- If maintaining humidity conditions within the chamber, check level of water (whether in pan or on chamber floor) and replenish as necessary.
- After power is disconnected to the unit, do not permit humidity water to remain in the unit. Remove any pans and/or dry out the interior thoroughly.
- Insofar as is possible, keep the incubator door closed in order to reduce the possibility of fungus growth from airborne organisms entering the chamber.

GENERAL INFORMATION: (Con't)

OPERATOR TESTS

EQUIPMENT REQUIRED FOR FOLLOWING TESTS:

- Amprobe
- Amprobe adapter cable
- Hand-held thermocouple meter
- Thermocouple for preceding meter

PRESSURE CHECK (every 18 months):

- Rotate the flowmeters to **OFF** and connect an air hose to the AIR and **CO_2** inlets.
- Apply 15 psi of air pressure. Apply soapy water to all lines and fittings between each inlet and flowmeter. Spend at least 5 minutes checking for leaks.
- If any bubbles are evident on any line or connection, replace lines or connections.

ELECTRICAL PERFORMANCE:

- Connect the male connector end from an amprobe adapter cable to the proper AC outlet for the unit under test.
- Connect the female end connector on the amprobe adapter cable to the unit under test.
- Using a calibrated amprobe with a range set at 15 amperes, connect the amprobe around the white lead on the amprobe adapter cable—the meter reading should be within 10% of the listed value for the model:

325GVT single: 6.7 amps per unit

GENERAL INFORMATION: (Con't)

OPERATOR TESTS (Con't)

PANEL CONTROL TESTS:

1. Fill the chamber with about ½" of water.

   - Press the power switch to the ON position. Install a thermocouple wire in the center of the inner chamber. Adjust the High Limit thermostat to its maximum clockwise position.
   - Adjust the Control Thermostat to stabilize the temperature at 37°C. Monitor the temperature with a thermocouple thermometer. Adjust the temperature calibration pot located on the front panel until the LED digital readout corresponds to the reading of the thermocouple thermometer.
   - Rotate the High Limit thermostat in the counterclockwise direction until the amber light over the Control thermostat goes out and the red light over the High Limit thermostat comes on. Once this has occurred, rotate the High Limit thermostat back to its maximum clockwise position.

2. Adjust the Control thermostat to its maximum clockwise position. Allow the inner chamber temperature to stabilize. Check thermocouple thermometer and LED readout—temperature must reach at least 60°C.

   If the maximum temperature is at least 60°C, proceed to Step 3.

3. Adjust the Door Heater Control Thermostat, located on the back panel, to its maximum clockwise position. Wait a few minutes and then touch liner of the outer door to check for heat—it should be warm.

   If liner of the outer door demonstrates that heating is occurring, proceed with testing.

4. With the chamber temperature still at 60°C and the air supply still attached, turn the air supply ON to a pressure of 15 psi. Check for water leaks around the door gasket and, if required, adjust the door tension to eliminate leaks.

5. While maintaining 15 psi air pressure and 60°C temperature, set and check operation of the Timer. Press the CO_2 Kwik-Inject pushbutton switch and recheck for door gasket leaks If required, readjust the door tension to stop any leaks.

6. If all conditions as stated in the preceding have been met, this phase of testing is complete.

SECTION 3

MAINTENANCE AND SERVICE

BE ADVISED:

NOTE: MAKE NO ATTEMPT TO SERVICE OR REPAIR A LAB-LINE PRODUCT UNDER WARRANTY BEFORE CONSULTING YOUR LAB-LINE DEALER. AFTER THE WARRANTY PERIOD, SUCH CONSULTATION IS STILL ADVISED, ESPECIALLY WHEN THE REPAIR MAY BE TECHNICALLY SOPHISTICATED OR DIFFICULT.

IF ASSISTANCE IS NEEDED BEYOND WHAT THE DISTRIBUTOR CAN PROVIDE, PLEASE CALL THE LAB-LINE CUSTOMER RELATIONS DEPARTMENT AT 708-450-2600 (IN ILLINOIS) OR 1-800/LAB-LINE (ELSEWHERE).

NO MERCHANDISE, HOWEVER, SHOULD BE RETURNED DIRECTLY TO LAB-LINE WITHOUT PRIOR APPROVAL.

CAUTION: DISCONNECT PLUG FROM ELECTRICAL OUTLET BEFORE ATTEMPT AND MAINTENANCE OR REPAIR OF THIS UNIT.

Preventive maintenance should be carried out at regular intervals as a protection against component failure.

Because incubators are basically of simple construction and work under very moderate conditions, there is usually little maintenance required. On the other hand it should be remembered that, because incubators run continuously, the interval between inspections should be short.

REGULAR MAINTENANCE:

Disconnect unit from electrical connection; be sure CO_2 flow is shut off.

EXTERIOR/INTERIOR CLEANING: Drain water from the reservoir at the bottom of the chamber and clean all exterior and interior chamber components with a solution of water and mild soap. Rinse thoroughly and dry. DO NOT USE CHLORINE-BASED SOLUTIONS OR CLEANSERS, HARSH ABRASIVES OR SCOURING PADS WITH METALLIC CONTENT. To remove built-up scale deposits, use a dilute acetic acid solution and a synthetic scrubber.

THERMOSTATS: Check that the thermostat contacts make and break the circuit cleanly and at regular intervals without prolonged sparking. This can be done either by visual inspection or by an ammeter.

GLASS DOOR: The fit between the glass door and the front gasket should be checked periodically—a badly fitting door can lead to loss of temperature and carbon dioxide.

MAINTENANCE AND SERVICE: (Con't)

REGULAR MAINTENANCE: (Con't)

ELECTRIC WIRING: Check wiring connections to see that they are secure. Similarly, wiring should be checked for any wear of insulation.

FIELD REPLACEABLE PARTS:

HEATERS: Located on outside surface of inner chamber.

THERMOSTATS: Body attached to control panel. Bulbs mounted inside inner chamber.

POWER SWITCH, INDICATOR LIGHTS, FLOWMETERS AND KWIK-INJECT TIMER & PUSHBUTTON: These are located on Control Panel.

KWIK-INJECT SOLENOID VALVE: Located on top of unit.

BLOWER MOTOR: Located on top of unit.

AXIAL FAN: Located behind protective cover on top plenum inside chamber.

WARNING: TO PREVENT ELECTRIC SHOCK, ALWAYS DISCONNECT POWER CORD BEFORE ATTEMPTING FIELD REPLACEMENT OF INCUBATOR PARTS.

MAINTENANCE AND SERVICE: (Con't)

PERFORMANCE TESTS:

EQUIPMENT REQUIRED FOR FOLLOWING TESTS:

- Amprobe
- Amprobe adapter cable
- Hand-held thermocouple meter
- Thermocouple for preceding meter

PRESSURE CHECK (every 18 months):

- Rotate the flowmeters to **OFF** and connect an air hose to the and **CO_2** inlets.
- Apply 15 psi of air pressure. Apply soapy water to all lines and fittings between each inlet and flowmeter. Spend at least 5 minutes checking for leaks.
- If any bubbles are evident on any line or connection, replace lines or connections.

ELECTRICAL PERFORMANCE:

- Connect the male connector end from an amprobe adapter cable to the proper AC outlet for the unit under test.
- Connect the female end connector on the amprobe adapter cable to the unit under test.
- Using a calibrated amprobe with a range set at 15 amperes, connect the amprobe around the white lead on the amprobe adapter cable—the meter reading should be within 10% of the listed value for the model:

  325GVT single: 6.7 amps per unit

MAINTENANCE AND SERVICE: (Con't)

PERFORMANCE TESTS: (Con't)

PANEL CONTROL TESTS:

1. Fill the chamber with about ½" of water.

   - Press the power switch to the ON position. Install a thermocouple wire in the center of the inner chamber. Adjust the High Limit thermostat to its maximum clockwise position.
   - Adjust the Control Thermostat to stabilize the temperature at 37°C. Monitor the temperature with a thermocouple thermometer. Adjust the temperature calibration pot located on the front panel until the LED digital readout corresponds to the reading of the thermocouple thermometer.
   - Rotate the High Limit thermostat in the counterclockwise direction until the amber light over the Control thermostat goes out and the red light over the High Limit thermostat comes on. Once this has occurred, rotate the High Limit thermostat back to its maximum clockwise position.

2. Adjust the Control thermostat to its maximum clockwise position. Allow the inner chamber temperature to stabilize. Check thermocouple thermometer and LED readout—temperature must reach at least 60°C.

   If the maximum temperature is at least 60°C, proceed to Step 3.

3. Adjust the Door Heater Control Thermostat, located on the back panel, to its maximum clockwise position. Wait a few minutes and then touch liner of the outer door to check for heat—it should be warm.

   If liner of the outer door demonstrates that heating is occurring, proceed with testing.

4. With the chamber temperature still at 60°C and the air supply still attached (from "Pressure Check," page OP-1), turn the air supply ON to a pressure of 15 psi. Check for water leaks around the door gasket and, if required, adjust the door tension to eliminate leaks.

5. While maintaining 15 psi air pressure and 60°C temperature, set and check operation of the Timer. Press the CO_2 Kwik-Inject pushbutton switch and recheck for door gasket leaks If required, readjust the door tension to stop any leaks.

6. If all conditions as stated in the preceding have been met, this phase of testing is complete.

MAINTENANCE AND SERVICE: (Con't)

PERFORMANCE TESTS: (Con't)

LIST OF RECOMMENDED TEST EQUIPMENT:

ITEM	PART NUMBER	QUANTITY
Digital Multimeter	589-037-00	1 each
Fyrite CO2 Analyzer	589-038-00	1 each
Digital Thermometer	910-133-00	1 each
Potentiometer	935-021-00	1 each

MAINTENANCE AND SERVICE: (Con't)

TROUBLESHOOTING:

TABLE 1: OPERATOR TESTS TROUBLESHOOTING

PROBLEM:	POSSIBLE CAUSE:	SOLUTION:
EXCESSIVE CO2 USE:	Possible leak from inner door gasket	Check integrity of gasket and replace if necessary
	Loose hose connections	Check and tighten where required
	Flow meters not set correctly	Review instructions and reset if required
	Pressure gauge on CO2 tank not set correctly	Review instructions—remember to check outflow pressure periodically from gas supply source
	Kwik-Inject dial set incorrectly	Review instructions
ERRATIC TEMPERATURE CONTROL:	High limit thermostat incorrectly set	Check setting and correct—remember reset high limit each time that the control temperature is changed
	Circulating fan stopped	Check operation and replace
CONDENSATION FORMS ON INNER GLASS DOOR:	Door heater in outer door not set properly	Check heater control on back of unit and reset if necessary
TEMPERATURE DISPLAY DOES MATCH INTERNAL TEMPERATURE:	Defective readout or temperature sensors	Check function and replace if required
	Unit out of calibration	Review instructions and recalibrate
INTERIOR SURFACES SUBJECT TO DISCOLORATION:	Humidification water allowed to remain in chamber after power is disconnected	Remember to remove pans, or standing water, and thoroughly dry interior

MAINTENANCE AND SERVICE: (Con't)

STORAGE:

For shipping purposes, the Model 325 Incubator is wrapped in polyethylene film. The unit is then sealed in a polyurethane, molded enclosure and packed in a corrugated carton.

It is recommended that the shipping container and materials be saved for storage purposes.

The complete unit is packed as two separate containers. When placing in storage, do not stack more than one container on another.

INDOOR STORAGE:

As packaged, the 325 Incubator will retain satisfactory operating performance when stored in indoor warehousing maintained in a dry condition and at a temperature range of 20°C to 90°C.

OUTDOOR STORAGE:

Outdoor storage is not recommended for the unit as shipped. This is especially true under conditions of wide variation in temperature and/or high humidity. While the polyethylene package and polyurethane molded enclosure provide satisfactory protection, the corrugated carton shipping container is not constructed for extended periods of outdoor storage.

INSPECTION:

Inspection of the unit should be carried out in an area and under conditions which are the same as normal operating conditions. Only under these circumstances can it be determined that no damage has resulted from transfer and/or shipping of the unit. Because of the polyurethane molded enclosure, the incubator is adequately protected from most types of damage resulting from shipping or movement, with the exception of violent dropping or striking as from the forks of a lift truck.

To determine that unit is fully operational, it must be connected to both electrical power source and gas supplies as outlined in the OPERATION section of this manual.

MAINTENANCE AND SERVICE: (Con't)

REPLACEMENT PARTS LIST:

TABLE 2:

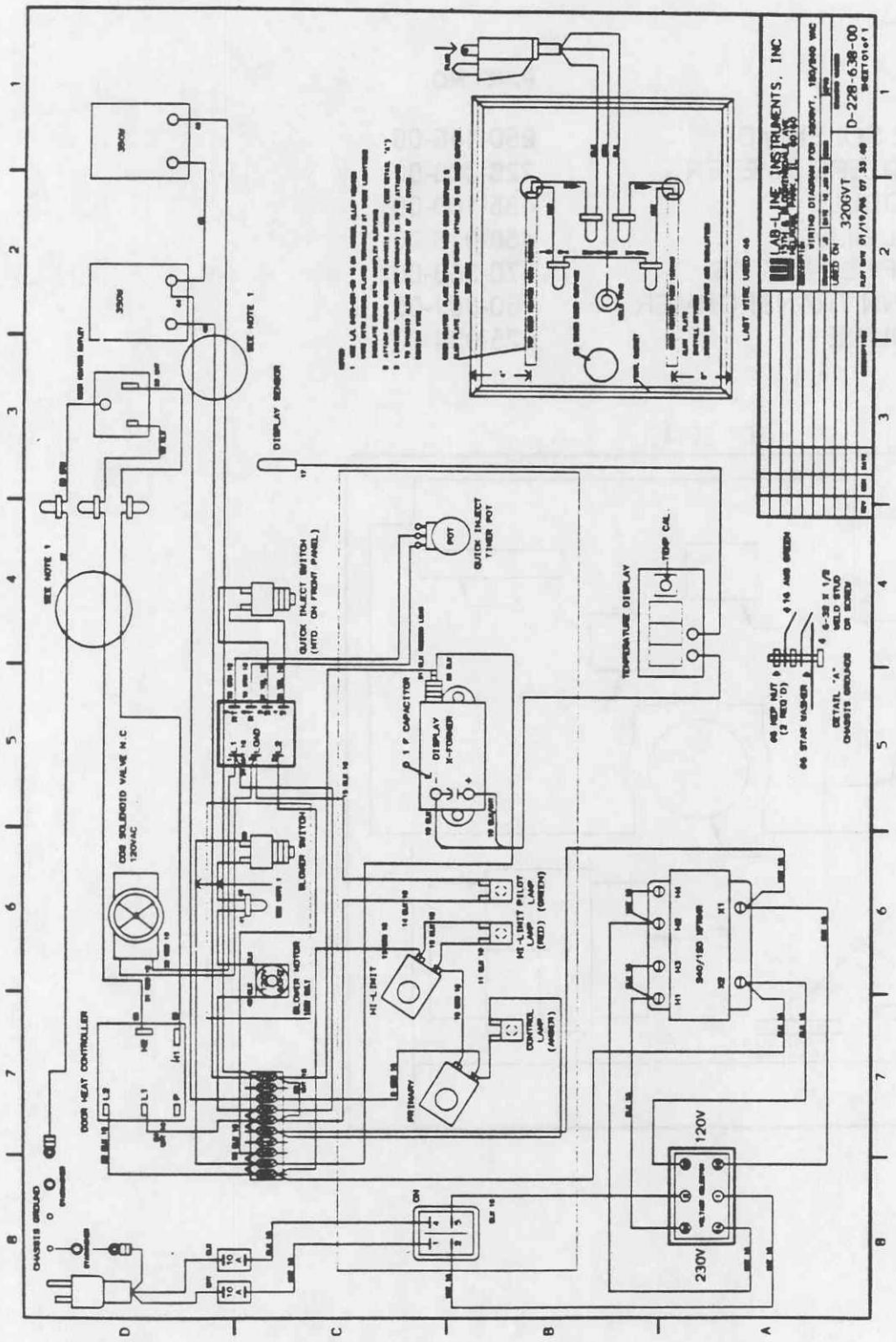
DESCRIPTION	PART NO.
Air Flow Meter:	660-101-00
Axial Fan:	160-136-00
Circuit Breaker, 10AMP:	330-119-00
Clear-Vue Inner Door:	014-940-00
CO_2 Flow Meter:	660-043-00
CO_2 Kwik-Inject Indicator Light:	360-238-00
CO_2 Kwik-Inject pushbotton switch:	440-080-00
CO_2 Kwik-Inject Timer:	485-180-00
CO_2 Sample Port:	660-100-00
Door Gasket (Inner Door):	530-192-00
Door Gasket (Outer Door):	530-189-00
Heater, 350 W/120V:	340-143-00
Heater, 1"WX20"L/100:	340-216-00
LED Temperature °C Readout:	228-088-00
Motor 115V/60Hz:	370-278-00
Power Switch ("On-Off" Switch):	440-359-00
Safety Thermostat:	920-301-00
Safety Thermostat Indicator Light:	360-234-01
Shelves:	593-108-00
Solenoid Valve, 1/4 BIB NC 120V:	950-148-00
Steel Outer Door:	017-330-00
Temperature Control Indicator Light:	360-235-01
Temperature Control Thermostat:	920-301-00

SECTION 4

DRAWINGS

DRAWINGS: (Con't)

Figure 8: 325GVT WIRING DIAGRAM

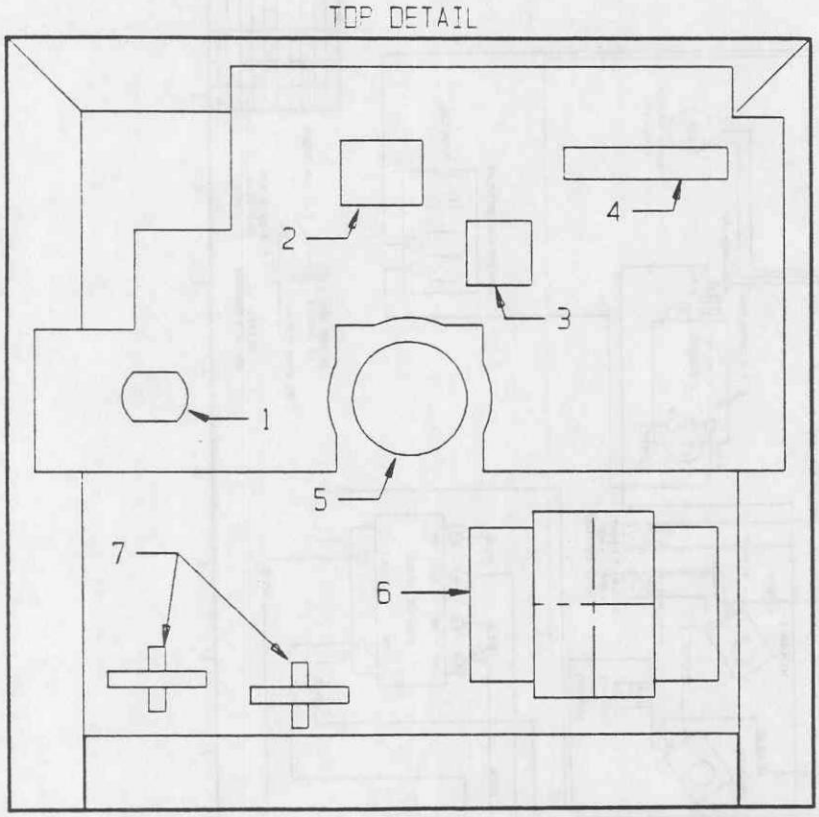


DRAWINGS: (Con't)

Figure 9: INDIVIDUAL ASSEMBLES

TOP DETAIL:

ITEM	PART NO.
1. 120V CO2 SOLENOID	950-148-00
2. DIGITAL THERMOMETER	228-088-00
3. TIMER MODULE	485-180-00
4. TERMINAL BLOCK	450-018-00
5. SHADED POLE MOTOR	370-363-00
6. STEPDOWN TRANSFORMER	460-301-00
7. FILTER INLINE	525-034-00

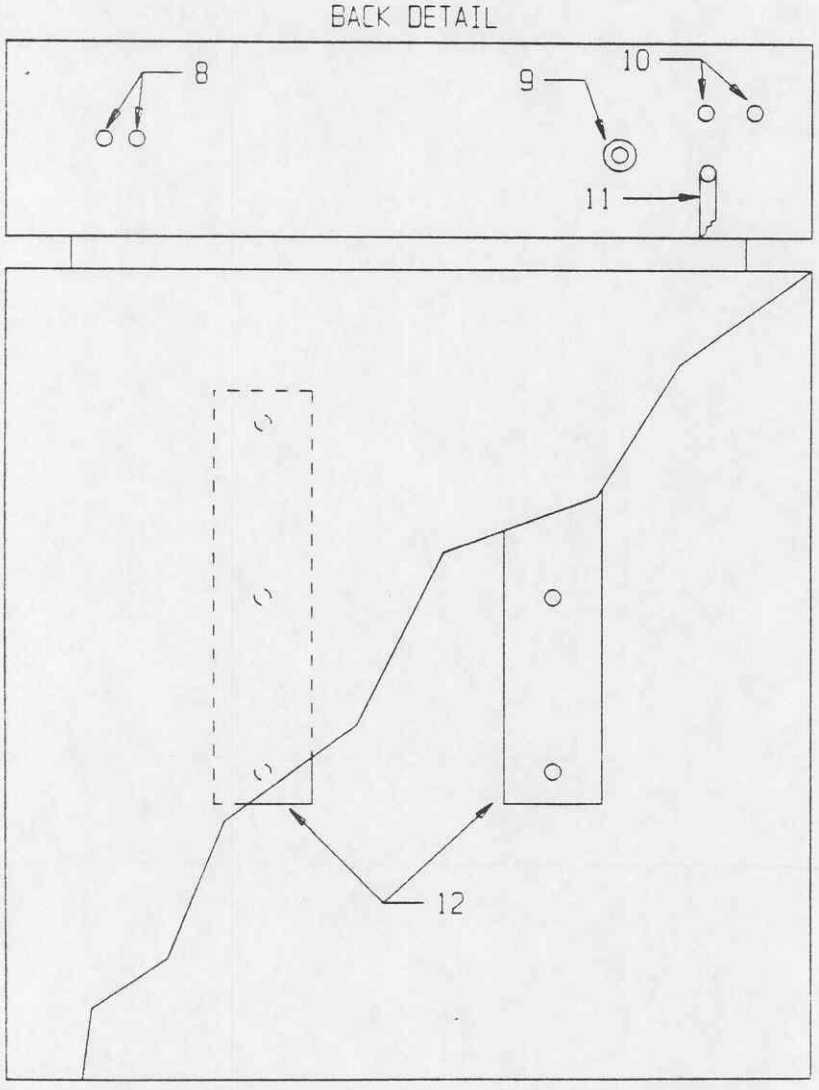


DRAWINGS: (Con't)

Figure 10: INDIVIDUAL ASSEMBLES (Con't)

BACK DETAIL:

ITEM	PART NO.
8. Hose Barb	730-901-00
9. Heat Control	920-251-00
10. Circuit Breaker 10AMP	330-119-00
11. Cordset	470-105-00
12. Heater 350 WATT	340-143-00



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6/96

SPECIAL EQUIPMENT COMMERCIAL OPERATING/INSTRUCTION MANUAL

MANUAL NO. 9-057-181-00
REV. NO. A

LAB-LINE® FLO-THRU® CO_2 INCUBATORS

MODEL Nos. | 325GVT
325-1GVT

LAB-LINE INSTRUMENTS, INC.
DESIGNERS AND MANUFACTURERS
15th and Bloomingdale Aves. , Melrose Park, IL 60160-1491 USA
PHONE: 708/450-2600 • 1-800/LAB-LINE • FAX: 450-0943

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12	(second to last)	Warranty

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Tables:

Table 1	TROUBLE-1	Troubleshooting
Table 2	REPLACE-1	Replacement Parts List

SECTION 1

INTRODUCTION

THANK YOU

for selecting Lab-Line Instruments for your equipment needs. For maximum value and ease of start-up,

PLEASE PROCEED AS FOLLOWS:

- Inspect the carton and contents for shipping damage. Notify the carrier immediately if damage is found.
- Use the Accessory Checklist when unpacking to verify that the complete unit has been received. Do not discard packing materials until all is accounted for.
- Read this Operation Manual thoroughly *before* deciding upon an appropriate location for the unit: you will want to consider the availability of power, water, hook-ups, drains and other unit requirements, as well as user convenience.
- Insist that every operator of this unit becomes familiar with the Operation Section of this manual.
- Be sure to fill out the Warranty Registration Card and mail it in to Lab-Line Instruments within seven (7) days after receiving the unit.

IF

after reading this manual you should have any difficulties with the installation or operation instructions, please call:

Lab-Line Customer Relations Department
708/450-2600 (in Illinois)
1-800/LAB-LINE (elsewhere)

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SECTION 2

SYSTEM FAMILIARIZATION

The CO_2 Incubators covered by this manual provide for the control of CO_2 concentration and temperature to create a growth environment for tissue cultures, plants, cells, viruses and related organisms. The incoming gas mixture passes through the rear plenum and is gently circulated throughout the chamber.

Separate flowmeters are adjustable for air and CO_2 rates and an access port on the control panel permits chamber gas samples to be taken.

Two hydraulic thermostats—one for setpoint control and another for overtemperature limit— regulate temperature. If the control thermostat should fail, the overtemperature-limit thermostat will protect chamber contents.

Strip-heaters on the outside of the chamber inner walls are positioned for uniform heat distribution, while high density fiberglass insulation minimizes heat loss. A fan in the chamber ceiling circulates chamber atmosphere to prevent temperature and CO_2 stratification.

The double door system has a tempered glass inner door which provides unobstructed viewing of the entire chamber. In the steel outer door are heaters which can be turned on to defog the glass inner door if necessary. Heat control for the steel outer door is on the back panel.

The leakproof chamber is constructed of heavy-gauge stainless steel and the steel cabinet has a baked enamel finish for easy cleaning. Stainless steel shelves are adjustable and removable.

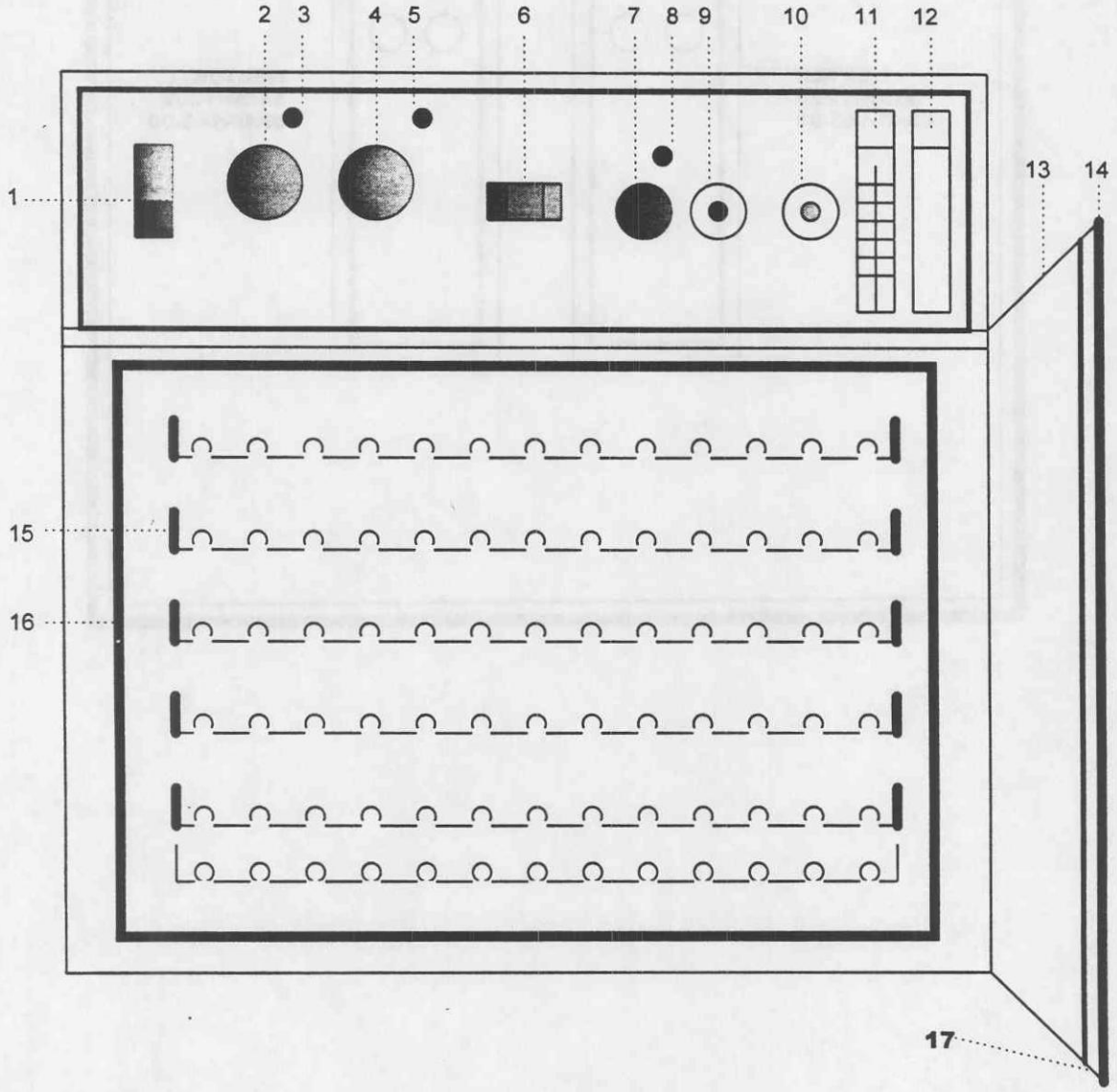
Humidification of the chamber is achieved by placing a pan with water on the floor of the chamber or by, filling bottom of the chamber with water with approximately ½" of water. Water used should be deionzed or distilled.

The two units making up the Model 325 have individual controls for each unit.

SYSTEM FAMILIARIZATION: (Con't)

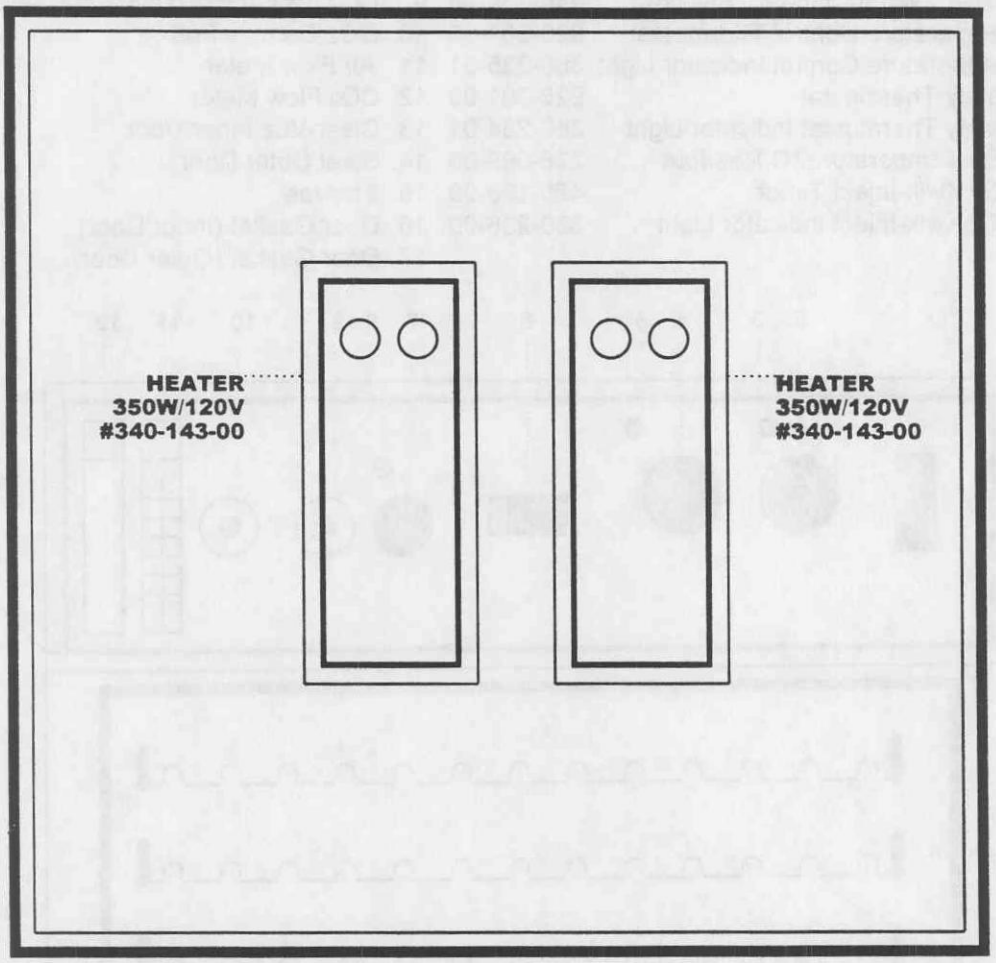
Figure 1: OVERALL UNIT/CONTROLS

ITEM:	PART NO.	ITEM:	PART NO.
1. Power Switch ("On-Off" Switch)	440-359-00	9. CO_2 Kwik-Inject pushbotton switch	440-080-00
2. Temperature Control Thermostat	920-301-00	10. CO_2 Sample Port	660-100-00
3. Temperature Control Indicator Light	360-235-01	11. Air Flow Meter	660-101-00
4. Safety Thermostat	920-301-00	12. CO_2 Flow Meter	660-043-00
5. Safety Thermostat Indicator Light	360-234-01	13. Clear-Vue Inner Door	014-940-00
6. LED Temperature °C Readout	228-088-00	14. Steel Outer Door	017-330-00
7. CO_2 Kwik-Inject Timer	485-180-00	15. Shelves	593-108-00
8 . CO_2 Kwik-Inject Indicator Light	360-238-00	16. Door Gasket (Inner Door)	530-192-00
		17. Door Gasket (Outer Door)	530-189-00



SYSTEM FAMILIARIZATION: (Con't)

Figure 2: POSITION OF HEATERS, BACK OF UNIT

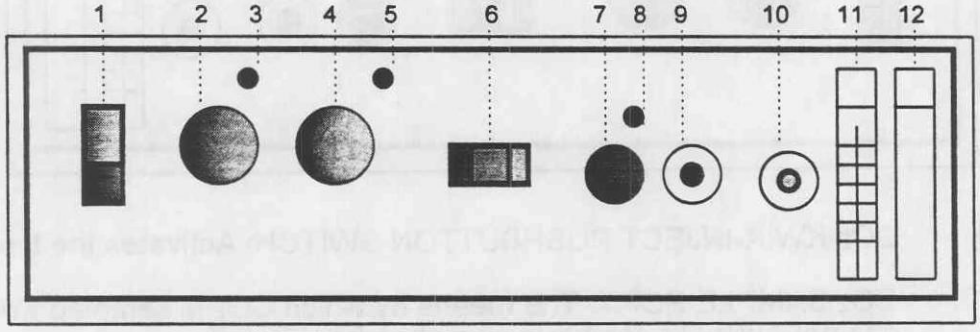


SECTION 3

FEATURES AND CONTROLS

Figure 3: CONTROL PANEL DETAIL

1. Power Switch ("On-Off" Switch)
2. Temperature Control Thermostat
3. Temperature Control Indicator Light
4. Safety Thermostat
5. Safety Thermostat Indicator Light
6. LED Temperature Readout
7. CO_2 Kwik-Inject Timer
8. CO_2 Kwik-Inject Indicator Light
9. CO_2 Kwik-Inject pushbutton switch
10. CO_2 Sample Port
11. Air Flow Meter
12. CO_2 Flow Meter



1. POWER SWITCH: Turns the unit on and off. The Power Switch will be lit when power is on.

2. TEMPERATURE CONTROL THERMOSTAT: Maintains chamber temperature to the desired level.

3. TEMPERATURE CONTROL INDICATOR LIGHT: Signals when heaters are cycling.

4. SAFETY THERMOSTAT: Should the Control Thermostat fail, this thermostat takes over and protects samples in the chamber.

5. SAFETY THERMOSTAT INDICATOR LIGHT: Signals that the Safety Thermostat is activated.

6. LED TEMPERATURE READOUT: Displays actual chamber temperature in degrees Celsius (°C).

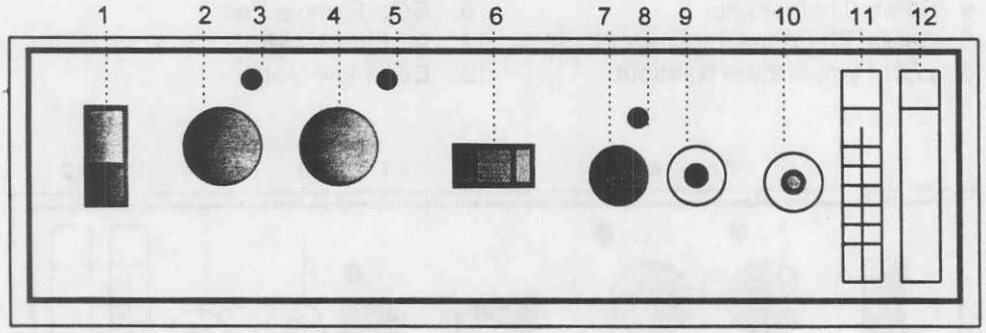
7. CO_2 KWIK-INJECT TIMER: Limits injection time.

8. CO_2 KWIK-INJECT INDICATOR LIGHT: Signals the solenoid is open and injecting gas into the system.

FEATURES AND CONTROLS: (Con't)

Figure 3: CONTROL PANEL DETAIL

1. Power Switch ("On-Off" Switch)
2. Temperature Control Thermostat
3. Temperature Control Indicator Light
4. Safety Thermostat
5. Safety Thermostat Indicator Light
6. LED Temperature Readout
7. CO_2 Kwik-Inject Timer
8. CO_2 Kwik-Inject Indicator Light
9. CO_2 Kwik-Inject pushbutton switch
10. CO_2 Sample Port
11. Air Flow Meter
12. CO_2 Flow Meter



9. CO_2 KWIK-INJECT PUSHBUTTON SWITCH: Activates the timer.

10. CO_2 SAMPLE PORT: The means by which CO_2 is sampled from the chamber without compromising chamber integrity.

11. AIR FLOW METER: Used in conjunction with the CO_2 Flow Meter, and the proper flow rates, it maintains the desired CO_2 level in the chamber.

12. CO2 FLOW METER: Used in conjunction with the Air Flow Meter, and the proper flow rates, it maintains the desired CO_2 level in the chamber.

SECTION 4

SPECIFICATIONS

TEMPERATURE:	Range: From slightly above ambient to 60°C. Control: ±0.5°C. Uniformity: ±0.2°C
HUMIDITY RANGE:	From ambient to 98% relative humidity.
CARBON DIOXIDE RANGE:	From 0 to 20% of the mixture.
ELECTRICAL REQUIREMENTS:	325: 120 VAC, 50/60 Hz, 6.7 Amps per unit (13.4 Amps total), 1600 Watts 325-1: 240 VAC, 50/60 Hz, 3.4 Amps per unit (6.8 Amps total), 1600 Watts
WEIGHT (NET), DUAL VERTICAL UNITS:	365 Pounds (166 kg)

DIMENSIONS:

Model	No. of Chambers	Overall	Single Chamber
325, 325-1	Dual, Vertical Units individually controllable	24½"W x 24"D x 65"H (62 x 61 x 165 cm)	22"W x 22"D x 22"H (56 x 56 x 56 cm)

Model	Volume	Shelves*	Shelf Area
325, 325-1	21,296 cu. in. 351,232 cu. cm. 12.4 cu. ft.	12	33.4 sq. ft

*A maximum of 20 shelves in dual units can be used.

UNIT'S ENVIRONMENTAL OPERATING CONDITIONS:

POLLUTION DEGREE:	2
INSTALLATION CATEGORY:	II
ALTITUDE:	2000 Meters MSL (Mean Sea Level)
HUMIDITY:	80% maximum, non-condensing
ELECTRICAL SUPPLY:	120VAC or 240VAC
VOLTAGE TOLERANCE:	±10% of normal rated line
TEMPERATURE:	15°C to 40°C
PRODUCT USAGE:	This product is intended for use indoors **only**

SECTION 5

INSTALLATION

The Model 325 is shipped as two units. One unit has a stacking-rack on top and is used as the floor or base unit. The other unit is then placed on top of the base unit.

Due to the weight of the units (approximately 154 pounds each), two persons using proper lifting technique should be used to remove the units from the cartons and position one on top of the other.

In the event of a need for subsequent storage, the shipping cartons and packing materials should be saved for repacking the units.

LOCATION:

Place the unit where it will be used, away from external vibration sources, drafts and wide variations in ambient temperature. Choose a location near a power supply that matches the unit nameplate requirements.

CAUTION: THIS UNIT IS DESIGNED FOR USE WITH **GASEOUS AIR, CO_2 OR NITROGEN ONLY. DO NOT USE WITH ANY OTHER GASES**. FAILURE TO OBSERVE THESE PRECAUTIONS CAN RESULT IN EXPLOSION AND/OR FIRE AND SERIOUS INJURY AND/OR DEATH AND PROPERTY DAMAGE.

GAS HOOK-UP:

Rotate all flowmeters on the incubator fully clockwise (closed). Connect air and CO_2 supply lines to their respective fittings on the back of the unit. Use ¼" ID tubing, flexible metal hose (meeting local codes) with filters to insure that the air and CO_2 are free of contaminants, for gas lines. (Please refer to Figure 4, page INS-2.)

Set the supply regulators at 10 psi. Check all of the connections for leaks using a sudsy solution of soap and water. Apply to the connections and observe if there is any breakthrough of bubbles that might result from a leaking gas. If any leaks are found, determine cause and make necessary repairs: these can include using sealing compounds, new gaskets or replacement of entire faulty part. If no leaks are found, proceed with the following steps.

NOTE: IN DUAL CHAMBER MODELS, EACH CHAMBER HAS A SEPARATE SET OF AIR AND GAS FITTINGS.

WARNING: HIGH CONCENTRATIONS OF CARBON DIOXIDE PRODUCE METABOLIC ABNORMALITIES, DISTURBANCES OF THE CENTRAL NERVOUS SYSTEM AND CARDIAC INSTABILITY—UNCONSCIOUSNESS MAY OCCUR AT CONCENTRATIONS ABOVE 10%.

INSTALLATION: (Con't)

HUMIDIFICATION:

To raise the humidity in a chamber to above ambient, add water by either placing a pan of water in the bottom of the chamber, or by adding water (maximum depth of ½") to the chamber floor. In either case, USE ONLY DISTILLED OR DEIONIZED WATER.

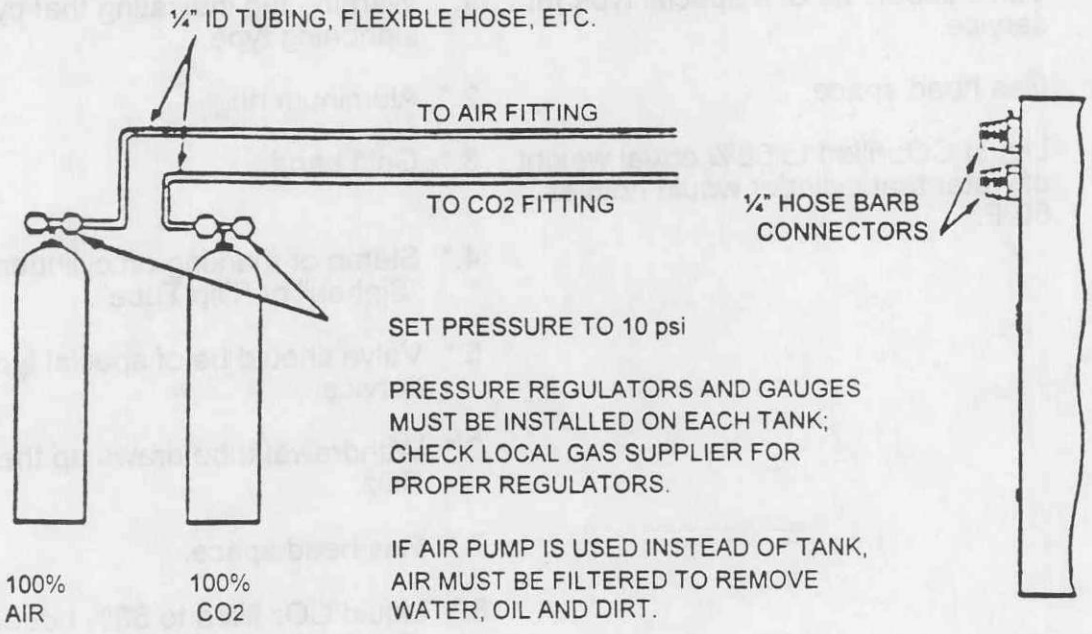
ELECTRICAL CONNECTION:

The unit is supplied with a 3-wire line cord. It should be plugged into an outlet designed for 3-prong plugs. For an outlet designed to accept 2-prong plugs (ungrounded), it is recommended that a qualified electrician replace it with a new grounded outlet.

If a plug must be installed, use only the 3-prong grounded type, rated for the unit load requirements and matching the power outlet. Make sure the green ground wire is secured to the plug ground terminal. (Please refer to the wiring diagram as necessary located at near the end of this manual, Section 11.)

Turn the Power Switch to **OFF** and insert the plug into the outlet.

Figure 3: AIR/CO_2 HOOK-UPS

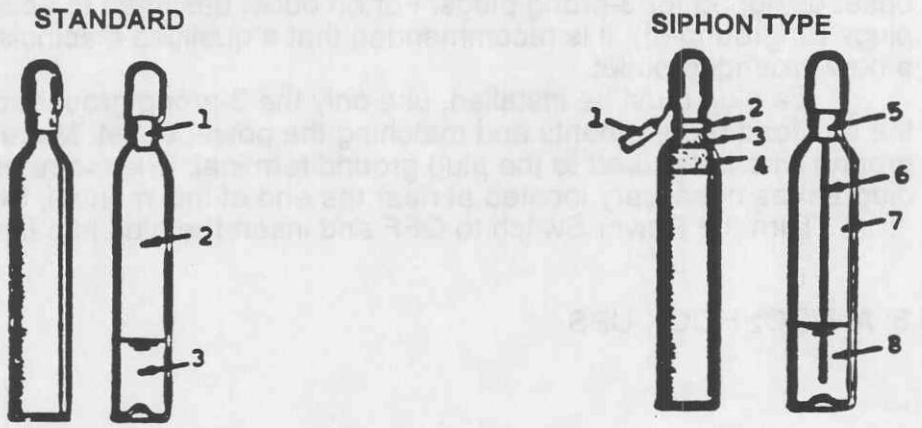

¼" ID TUBING, FLEXIBLE HOSE, ETC.
TO AIR FITTING
TO CO2 FITTING
¼" HOSE BARB CONNECTORS
SET PRESSURE TO 10 psi
PRESSURE REGULATORS AND GAUGES MUST BE INSTALLED ON EACH TANK; CHECK LOCAL GAS SUPPLIER FOR PROPER REGULATORS.
IF AIR PUMP IS USED INSTEAD OF TANK, AIR MUST BE FILTERED TO REMOVE WATER, OIL AND DIRT.
100% AIR
100% CO2

INSTALLATION: (Con't)

CO_2 CONNECTION:

Be sure to use lab-grade, dry carbon dioxide cylinders. Do not use a CO_2 cylinder marked "Siphon" or "Dip Tube"; these are used expressly for making dry ice and are not suitable for use with this incubator. (See the comparison below.)

Figure 4: STANDARD AND SIPHON TYPE CO_2 GAS CYLINDERS



1. Valve should be of a special type for service.
2. Gas head space.
3. Liquid CO_2 filled to 68% equal weight of water that cylinder would hold at 60°F.

1. Warning tag indicating that cylinder is siphoning type.
2.* Aluminum ring.
3.* Gold band.
4.* Stamp or marking on cylinder: "Siphon" or "Dip Tube".
5.* Valve should be of special type for service.
6.* Withdrawal tube draws up the liquid CO_2.
7.* Gas head space.
8.* Liquid CO_2 filled to 68% equal weight of water that cylinder will hold at 60°F.

* SOME GAS SUPPLIERS WILL HAVE NO MARKINGS TO INDICATE A "DIP TUBE" OR "SIPHON" TYPE CYLINDER. **BE SURE TO ORDER DRY, LAB-GRADE CO_2.**

SECTION 6

OPERATION

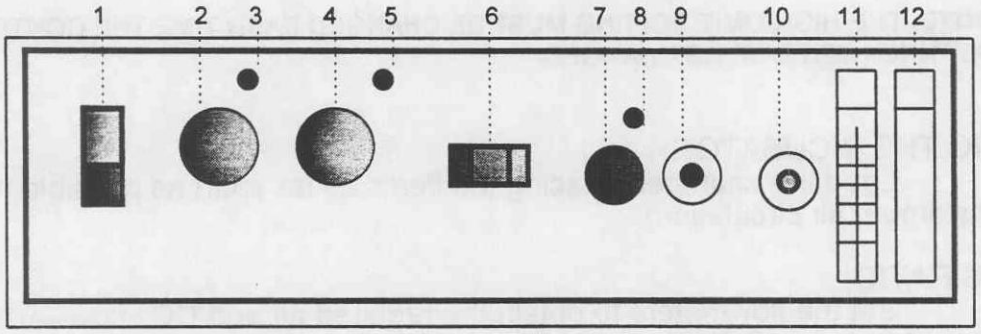
DANGER: DO NOT USE IN THE PRESENCE OF FLAMMABLE OR COMBUSTIBLE MATERIALS OR EXPLOSIVE GASES. DO NOT USE IN THE PRESENCE OF PRESSURIZED OR SEALED CONTAINERS. FIRE OR EXPLOSION MAY RESULT, CAUSING DEATH OR SEVERE INJURY.

WARNING: DO NOT HEAT ANY SUBSTANCE ABOVE A TEMPERATURE WHICH WILL CAUSE IT TO EMIT TOXIC FUMES. DEATH OR SEVERE INJURY MAY RESULT.

NOTICE: WE RECOMMEND THAT UNIT RUN 24 HOURS EMPTY BEFORE INTRODUCING MEDIA TO BE INCUBATED. THIS WILL FACILITATE EASE OF SERVICING, IF REQUIRED, AND NULLIFY THE NEED TO DECONTAMINATE CHAMBER IN THE EVENT OF A PROBLEM OCCURRING.

Figure 6: CONTROL PANEL

1. Power Switch ("On-Off" Switch)
2. Temperature Control Thermostat
3. Temperature Control Indicator Light
4. Safety Thermostat
5. Safety Thermostat Indicator Light
6. LED Temperature Readout
7. CO_2 Kwik-Inject Timer
8. CO_2 Kwik-Inject Indicator Light
9. CO_2 Kwik-Inject pushbutton switch
10. CO_2 Sample Port
11. Air Flow Meter
12. CO_2 Flow Meter



OPERATION: (Con't)

STARTING THE UNIT:

Push the Power Switch to **ON**. The Power Switch will be lit when power is **ON**. Dual chamber models have two separate Power Switches and Power Lamps. The chambers can be used independently or together.

SETTING THE TEMPERATURE CONTROL THERMOSTAT:

A. Rotate the High-Limit Thermostat fully clockwise; then rotate the Control Thermostat clockwise to approximate desired temperature (the setpoint).

B. Allow time for chamber temperature to stabilize before proceeding. The Control Lamp is lit when heaters are energized and not lit when heaters are not energized (between heating cycles). Allow several heating cycles to pass.

C. Check the LED temperature readout on control panel, then adjust the Control Thermostat closer to the desired setpoint—rotate the knob clockwise to raise the temperature, counterclockwise to lower it.

D. Repeat Steps B and C above as needed until setpoint is maintained.

SETTING THE HIGH LIMIT THERMOSTAT:

- When the Control Lamp is lit, rotate the High Limit Thermostat counterclockwise until the Control Lamp goes out and High Limit Lamp is lit.

- Turn the High Limit Thermostat back clockwise slowly, just until the Control Lamp is again lit. Then rotate it another 5 degrees clockwise to set the High Limit Thermostat slightly higher than the Control Thermostat.

NOTE: THE HIGH LIMIT SETTING MUST BE CHANGED EACH TIME THE CONTROL SETTING (SETPOINT) IS CHANGED.

LOADING THE INCUBATOR:

Load the chamber, spacing the items as far apart as possible (for maximum air circulation).

AIR/GAS RATIO:

Set the flowmeters to obtain the required air and CO_2 flow—using the lowest possible CO_2 flow rate will help to conserve gas.

OPERATION: (Con't)

Use one of the following formulas or the nomogram on next page (OP-4) of this manual to find the desired air-to-gas ratio:

R = % CO_2 in the chamber atmosphere
A = Air flow in liters/minute
C = CO_2 flow in liters/minute

Equation 1 (to be used if air and CO_2 flow rates are known):

$$R = \frac{C}{A + C} \times 100$$

Equation 2 (to be used if air flow rate and % CO_2 are known):

$$C = \frac{RA}{100 - R} \text{ liters/min.}$$

Equation 3 (to be used if CO_2 flow rate and % CO_2 are known):

$$A = \frac{100C - RC}{R} \text{ liters/min.}$$

EXAMPLE 1: If a CO_2 percentage of 15% is desired at a flow rate of 0.4 liters/min. of CO_2 use Equation 3:

$$A = \frac{100\,(0.4) - 15\,(0.4)}{15} = \frac{40 - 6}{15}$$

$$= 2.26 \text{ liters/min. of air}$$

EXAMPLE 2: If flow rates are set 0.1 liters/min. of CO_2 and 3 liters/min. of air, use Equation 1 to find percentage of CO_2:

$$R = \frac{0.1}{3.0 + 0.1} \times 100 = 3.2\% \; CO_2 \text{ in chamber atmosphere}$$

KWIK-INJECT SYSTEM:

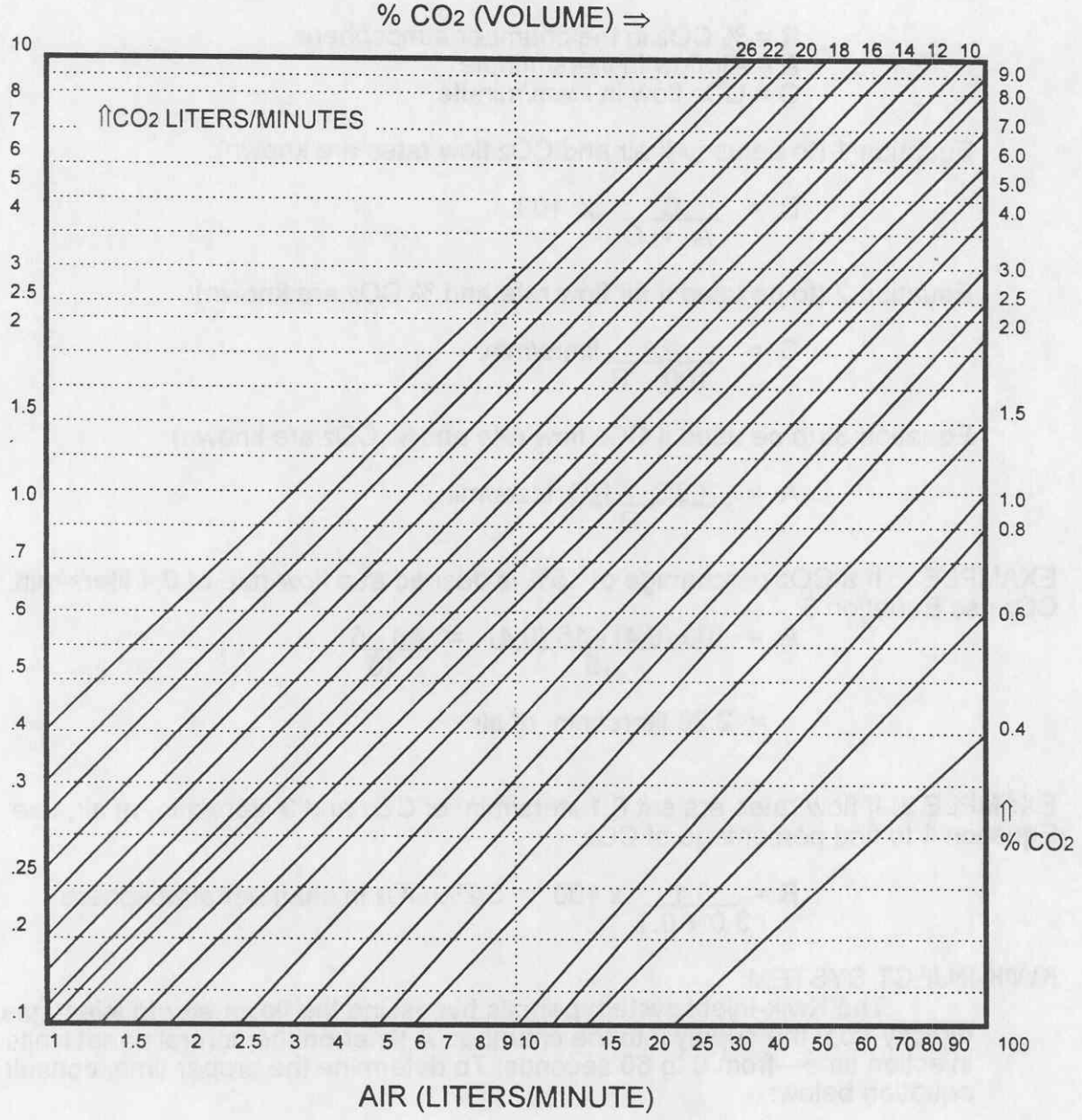
The Kwik-Inject system permits bypassing the flowmeter to inject gas directly from the supply into the chamber. A timer on the control panel limits injection time—from 0 to 60 seconds. To determine the proper time, consult the equation below:

MODEL	TANK	PRESSURE TIME (T)
All models	10 psi	$T = 1.28 \times \%\ CO_2$

Set the timer to the calculated time and push the button to the right side of the timer when rapid CO_2 injection is desired.

OPERATION: (Con't)

Figure 7: AIR/CO-2 RATIO NOMOGRAM



NOTE: THIS CHART SHOWS THE CO2 FLOW RATE (LITERS/MINUTE) REQUIRED FOR A SPECIFIC AIR/CO2 RATIO. DRAW A VERTICAL LINE FROM THE POINT REPRESENTING THE AIR FLOW RATE ON THE HORIZONTAL AXIS UNTIL IT INTERSECTS WITH THE DESIRED CO2 FLOW RATE.

TO OBTAIN THE AIR FLOW RATE, WITH CO2 FLOW RATE (LITERS/MIN.) AND CO2 PERCENTAGE KNOWN, REVERSE THE ABOVE PROCEDURE.

OPERATION: (Con't)

HUMIDITY ADJUSTMENT:

Chamber humidity can be raised by placing pan with water on chamber floor, or by adding water (maximum depth of ½") to chamber floor. For minimum humidity chamber should be dry.

CO_2 SAMPLING/MEASUREMENT:

Insert sample probe into CO_2 Sample Port (Item No. 10 on Control Panel; see Figure 6 page OP-1) making sure that a tight seal is attained. Obtain a sample of CO_2 sufficiently large to meet the requirements of the analytical apparatus or procedure being used. Perform CO_2 analysis.

DOOR DEFOGGER

The door heat control on the back panel should be off except when fogging of the inner door occurs. If this happens close the outer door and turn on the heat control—rotate it counterclockwise to increase heat and clockwise to decrease heat. Wait a few minutes before opening door to see if fog dissipates. If not, turn control in increments of 1 to higher setting.

OPERATING SUGGESTIONS:

- In order to obtain and maintain the desired CO_2 gas pressure, periodically check the tightness and integrity of the gasket which secures the glass door to the chamber.
- To be sure of maintaining desired gas pressure, periodically check outflow pressure from gas supply source.
- If maintaining humidity conditions within the chamber, check level of water (whether in pan or on chamber floor) and replenish as necessary.
- After power is disconnected to the unit, do not permit humidity water to remain in the unit. Remove any pans and/or dry out the interior thoroughly.
- Insofar as is possible, keep the incubator door closed in order to reduce the possibility of fungus growth from airborne organisms entering the chamber.

OPERATION: (Con't)

REQUIRED EQUIPMENT BUT NOT SUPPLIED

- Carbon Dioxide Gas Cylinder: Type T or K cylinder or equivalent per local supply.

  Quantity required: One for each of the incubators.

- Air Cylinder: Type T or K cylinder or equivalent per local supply.

  Quantity required: One for each of the incubators.

- ¼" ID tubing or flexible hose rated for indicated gas service.

  Quantity required: Length dependent on site of use.

- 2-stage gas regulator.

  Quantity required: One for each of the cylinders—or a total of 4.

- Stainless steel pan to hold water for humidification purposes. Approximate measurement: 20" W x 20" D x 2" H

  Quantity required: One pan for each incubator.

SECTION 7

OPERATOR TESTS

EQUIPMENT REQUIRED FOR FOLLOWING TESTS:

- Amprobe
- Amprobe adapter cable
- Hand-held thermocouple meter
- Thermocouple for preceding meter

PRESSURE CHECK (every 18 months):

- Rotate the flowmeters to **OFF** and connect an air hose to the AIR and **CO_2** inlets.
- Apply 15 psi of air pressure. Apply soapy water to all lines and fittings between each inlet and flowmeter. Spend at least 5 minutes checking for leaks.
- If any bubbles are evident on any line or connection, replace lines or connections.

ELECTRICAL PERFORMANCE:

- Connect the male connector end from an amprobe adapter cable to the proper AC outlet for the unit under test.
- Connect the female end connector on the amprobe adapter cable to the unit under test.
- Using a calibrated amprobe with a range set at 15 amperes, connect the amprobe around the white lead on the amprobe adapter cable—the meter reading should be within 10% of the listed value for the model:

325GVT single: 6.7 amps per unit

OPERATOR TESTS: (Con't)

PANEL CONTROL TESTS:

1. Fill the chamber with about ½" of water.

   - Press the power switch to the ON position. Install a thermocouple wire in the center of the inner chamber. Adjust the High Limit thermostat to its maximum clockwise position.

   - Adjust the Control Thermostat to stabilize the temperature at 37°C. Monitor the temperature with a thermocouple thermometer. Adjust the temperature calibration pot located on the front panel until the LED digital readout corresponds to the reading of the thermocouple thermometer.

   - Rotate the High Limit thermostat in the counterclockwise direction until the amber light over the Control thermostat goes out and the red light over the High Limit thermostat comes on. Once this has occurred, rotate the High Limit thermostat back to its maximum clockwise position.

2. Adjust the Control thermostat to its maximum clockwise position. Allow the inner chamber temperature to stabilize. Check thermocouple thermometer and LED readout—temperature must reach at least 60°C.

   If the maximum temperature is at least 60°C, proceed to Step 3.

3. Adjust the Door Heater Control Thermostat, located on the back panel, to its maximum clockwise position. Wait a few minutes and then touch liner of the outer door to check for heat—it should be warm.

   If liner of the outer door demonstrates that heating is occurring, proceed with testing.

4. With the chamber temperature still at 60°C and the air supply still attached (from "Pressure Check," page OP/TEST-1), turn the air supply ON to a pressure of 15 psi. Check for water leaks around the door gasket and, if required, adjust the door tension to eliminate leaks.

5. While maintaining 15 psi air pressure and 60°C temperature, set and check operation of the Timer. Press the CO_2 Kwik-Inject pushbutton switch and recheck for door gasket leaks If required, readjust the door tension to stop any leaks.

6. If all conditions as stated in the preceding have been met, this phase of testing is complete.

SECTION 8

TROUBLESHOOTING

TABLE 1: OPERATOR TESTS TROUBLESHOOTING

PROBLEM:	POSSIBLE CAUSE:	SOLUTION:
EXCESSIVE CO2 USE:	Possible leak from inner door gasket	Check integrity of gasket and replace if necessary
	Loose hose connections	Check and tighten where required
	Flow meters not set correctly	Review instructions and reset if required
	Pressure gauge on CO2 tank not set correctly	Review instructions—remember to check outflow pressure periodically from gas supply source
	Kwik-Inject dial set incorrectly	Review instructions
ERRATIC TEMPERATURE CONTROL:	High limit thermostat incorrectly set	Check setting and correct—remember reset high limit each time that the control temperature is changed
	Circulating fan stopped	Check operation and replace
CONDENSATION FORMS ON INNER GLASS DOOR:	Door heater in outer door not set properly	Check heater control on back of unit and reset if necessary
TEMPERATURE DISPLAY DOES MATCH INTERNAL TEMPERATURE:	Defective readout or temperature sensors	Check function and replace if required
	Unit out of calibration	Review instructions and recalibrate
INTERIOR SURFACES SUBJECT TO DISCOLORATION:	Humidification water allowed to remain in chamber after power is disconnected	Remember to remove pans, or standing water, and thoroughly dry interior

SECTION 9

STORAGE

For shipping purposes, the Model 325 Incubator is wrapped in polyethylene film. The unit is then sealed in a polyurethane, molded enclosure and packed in a corrugated carton.

It is recommended that the shipping container and materials be saved for storage purposes.

The complete unit is packed as two separate containers. When placing in storage, do not stack more than one container on another.

INDOOR STORAGE:

As packaged, the 325 Incubator will retain satisfactory operating performance when stored in indoor warehousing maintained in a dry condition and at a temperature range of 20°C to 90°C.

OUTDOOR STORAGE:

Outdoor storage is not recommended for the unit as shipped. This is especially true under conditions of wide variation in temperature and/or high humidity. While the polyethylene package and polyurethane molded enclosure provide satisfactory protection, the corrugated carton shipping container is not constructed for extended periods of outdoor storage.

INSPECTION:

Inspection of the unit should be carried out in an area and under conditions which are the same as normal operating conditions. Only under these circumstances can it be determined that no damage has resulted from transfer and/or shipping of the unit. Because of the polyurethane molded enclosure, the incubator is adequately protected from most types of damage resulting from shipping or movement, with the exception of violent dropping or striking as from the forks of a lift truck.

To determine that unit is fully operational, it must be connected to both electrical power source and gas supplies as outlined in the OPERATION section of this manual.

SECTION 10

REPLACEMENT PARTS LIST

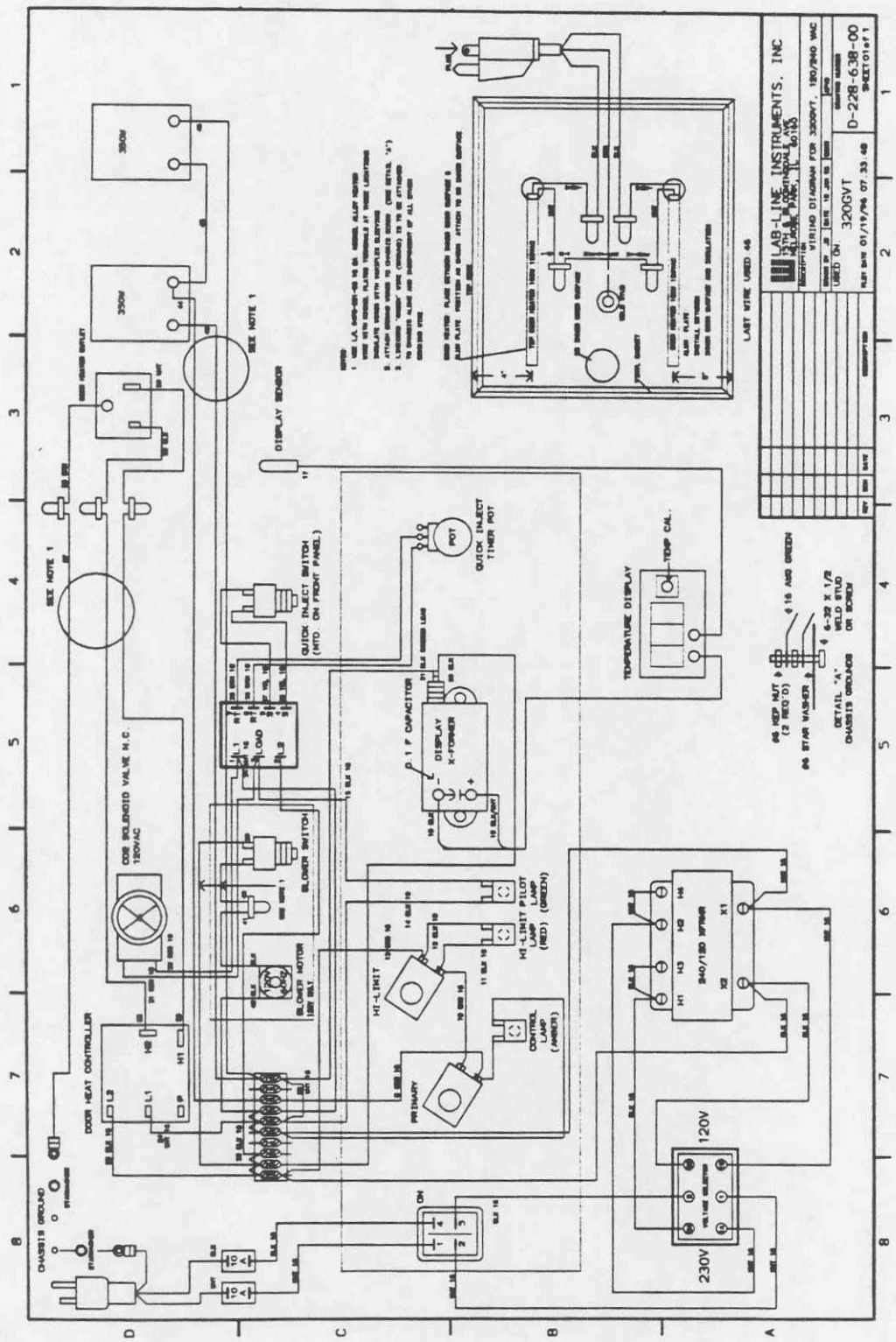
TABLE 2:

DESCRIPTION	PART NO.
Air Flow Meter:	660-101-00
Axial Fan:	160-136-00
Circuit Breaker, 10AMP:	330-119-00
Clear-Vue Inner Door:	014-940-00
CO_2 Flow Meter:	660-043-00
CO_2 Kwik-Inject Indicator Light:	360-238-00
CO_2 Kwik-Inject pushbotton switch:	440-080-00
CO_2 Kwik-Inject Timer:	485-180-00
CO_2 Sample Port:	660-100-00
Door Gasket (Inner Door):	530-192-00
Door Gasket (Outer Door):	530-189-00
Heater, 350 W/120V:	340-143-00
Heater, 1"WX20"L/100:	340-216-00
LED Temperature °C Readout:	228-088-00
Motor 115V/60Hz:	370-278-00
Power Switch ("On-Off" Switch):	440-359-00
Safety Thermostat:	920-301-00
Safety Thermostat Indicator Light:	360-234-01
Shelves:	593-108-00
Solenoid Valve, 1/4 BIB NC 120V:	950-148-00
Steel Outer Door:	017-330-00
Temperature Control Indicator Light:	360-235-01
Temperature Control Thermostat:	920-301-00

SECTION 11

WIRING SCHEMATIC

Figure 8: 325GVT WIRING SCHEMATIC



WARRANTY

LAB-LINE INSTRUMENTS, INC., for itself and all of its subsidiaries ("Lab-Line"), does hereby warrant for a period of 15 months from the date of receipt by the User, under normal and proper usage, all of its products (except P.A.C.E. anaerobic chambers) against defects in workmanship and material, and will repair or replace any defective part(s) without charge when same is shipped prepaid to the authorized Lab-Line distributor from which the product was originally purchased. P.A.C.E. anaerobic chambers are warranted for a period of 12 months, except the vinyl front panel and rubber sleeves/gloves which are warranted for 30 days, from the date of receipt by the User.

Should the nature of any defect require that the product, or any constituent portion thereof be returned by such authorized distributor to Lab-Line's factory in Melrose Park, Illinois, prepaid, for service, a condition precedent to any return shall be the procurement by such dealer of written authorization from Lab-Line assigning a Return Goods Number to the product or part requiring service.

Parts and accessories manufactured by others are warranted only to the extent of the regular warranty of the manufacturer or supplier of such materials and only insofar as Lab-Line is able to transfer the benefits of warranty coverage, if any, to the User. Any adequately warranted defective part or accessory manufactured or supplied by others may be exchanged through an authorized Lab-Line dealer for a replacement part, and no charge in respect thereof shall be assessed if the defective part is shipped prepaid and received at Lab-Line's factory within 30 days from the date any replacement part is obtained by the User.

This warranty supersedes and is given in lieu of all implied warranties, and is void if the User does not provide the unit with continuous ample electric power at constant voltage, consistent with the specifications of the product.

With respect to all Explosion-Proof and Flammable Material Storage (FMS) Refrigerators and Freezers, storage by User of any materials in the product which may cause deterioration of any components of the product shall be deemed to constitute abnormal and improper usage for the purposes of this warranty.

TO OBTAIN BENEFITS CONFERRED BY THIS WARRANTY, USER MUST RETURN THE WARRANTY CARD TO LAB-LINE WITH SEVEN (7) BUSINESS DAYS AFTER RECEIPT OF THE PRODUCT.

LAB-LINE INSTRUMENTS, INC.
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15th & Bloomingdale Avenues
Melrose Park, IL 60160-1491 USA
708/450-2600

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